EG&G ROCKY FLATS

# INTEROFFICE CORRESPONDENCE

FEB - 1

DATE: January 20, 1994

TO: S. R. Keith, Solar Pond Program, Bldg. 080, X8541

FROM: D. R. Swanson, Safety Analysis Engineering, Bldg. T886B, X7009

SUBJECT: 750 PAD ACCELERATED SOLAR POND SLUDGE REMOVAL SAFETY ANALYSIS FOR 207C POND AND CLARIFIER - DRS-006-94

PURPOSE

This letter is to transmit the results of the Safety Analysis for the 207C Pond and Clarifier portion of the Accelerated Solar Pond Sludge Removal Project (ASPSRP) and a copy of the calculations that support the safety analysis.

DISCUSSION

The Department of Energy (DOE) Order 5480.23, "Nuclear Safety Analysis Reports", requires, in part, that nuclear facilities perform or upgrade their Safety Analysis Reports (SARs) to comply with the DOE Order. The DOE Order requires that a Basis for Interim Operations (BIO) be prepared for the interim period until the SAR is approved.

There currently exists a draft SAR for the 750/904 Pad that assumes that the waste form to be stored on the 750 Pad will be pondcrete, produced from the solar pond sludge, or saltcrete produced from the Building 374 evaporator concentrate. On the other hand, the ASPSRP will remove and store solar pond sludge and brine/sludge mixtures in 10,000 gallon tanks on the 750 Pad.

Since the draft SAR did not consider the storage of sludge or brine/sludge mixtures, the attached Safety Analysis (Attachment 1) evaluates the hazards associated with these operations for the 207C Pond and Clarifier and concludes that these operations will be within the safety envelope of the draft SAR. A draft revised BIO that reflects the ASPSRP was prepared for the evaluation of the 207A/B Pond sludge removal. This BIO, with minor modifications, is still appropriate for the 207C and Clarifier brine/sludge removal and storage task. The calculations that support the Safety Analysis are documented in calculation number 94-SAE-001. A copy of the approved calculation is attached (Attachment 2).

The BIO will ultimately be submitted to DOE as part of the revised Safety Analysis Program Implementation Plan for DOE Order 5480.23. The BIO and supporting safety analysis will superseded upon DOE approval of the draft SAR. The current estimated date for submittal of the SAR to DOE is July 1, 1994.

DOCUMENT CLASSIFICATION REVIEW WAIVER PER CLASSIFICATION OFFICE

RESPONSE
If you have any questions or comments, please contact A. C. Stalker at X8484/DP7565.

ACS:la

Attachments:
As Stated (2)

cc:
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# 750 PAD ACCELERATED SOLAR POND SLUDGE REMOVAL SAFETY ANALYSIS

## 207C Pond and Clarifier Solution Removal and Storage

Prepared by: Allan C. Stalker
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Date: January 19, 1994

# 750 PAD ACCELERATED SOLAR POND SLUDGE REMOVAL SAFETY ANALYSIS
## 207C Pond and Clarifier Solution Removal and Storage

## 1.0 INTRODUCTION

The accelerated solar pond sludge removal program will remove sludge from the solar ponds and store the sludge on the 750 Pad in 10000 gallon double walled polyethylene tanks. A minimum of 45 tanks will be required for the storage of the 207C Pond sludge and solution, and 3 for the clarifier sludge and solution. Water will be added to the 207C Pond to reach a total volume of 450000 gallons. The pond will be circulated to dissolve as much salt as possible and suspend the insoluble sludge. This salt brine with suspended sludge will be sucked into a 13 cubic meter (17 $yd^3$) truck, driving the loaded truck to the storage tank, and pumping the brine/sludge solution into the tank. This operation will be repeated until the pond is empty. The clarifier will be stirred until the brine solution and sludge is thoroughly mixed and then the mixture will be sucked into the truck, driven to the storage tank, and pumped into the tank. This operation will continue until the clarifier is empty. Twenty-three tanks will have already been filled with the sludge from the 207A/B Ponds.

## 2.0 DESCRIPTION OF EQUIPMENT

The vacuum truck is called the "Guzzler" and operates with a Dresser or Hargreaves Positive Displacement Vacuum Pump rated at 380 mm (15") of Hg and 5141 CFM at full vacuum. The truck has a 13 cubic meter (17 $yd^3$) Cleanbore Body, designed for maximum separation of heavier materials from the air stream. The payload capacity is rated at 12.2 $m^3$ (16 $yd^3$). It has four removable 16" top mounted centrifugal separators with easy access clean-out ports to insure maximum separation of material and dust from air stream prior to the baghouse stage filtration. The baghouse has 60 acrylic coated filter bags with an automatic bag pulsing feature. It has a stainless screen fitted in the vacuum tube make-break connection as a fail-safe barrier to any pump damaging material.

The truck will be driven to the solar pond. The truck mounted suction hose will be attached to a boom mounted extension hose and collection wand at the solar pond. The truck will be loaded with 12.2 $m^3$ of sludge. When the truck is full the hose will be sucked empty. The boom extension will be disconnected and a cap will be installed for the trip to the 750 Pad. The truck will then be driven to the 750 Pad.

Each storage tank set will consist of a closed primary tank 13'6" in diameter inside of a 14' secondary open top containment tank, with a maximum capacity of 11500 gallons. The working volume is 10000 gallons. Both tanks are constructed of high density crosslinked polyethylene. The wall thickness is calculated for the appropriate hoop stress for sludge up to a specific gravity of 1.9. A leak detection system is provided to detect leaks from the primary tank into the secondary

containment tank. Twenty of these tank sets will be in Tent 3, 22 tanks in Tent 4, and 29 tanks in Tent 6. The tanks will be located on both sides of the tent with sufficient aisle space between the tanks to drive the transfer truck.

The vacuum truck will be backed into the tent to the tank to be filled. A sludge pump, rated at 200 gpm maximum, will be connected to the polyethylene tank with a three inch line. It will take from 16 to 30 minutes to empty the truck into a tank. Each tank will be filled with approximately 10000 gallons of sludge or brine solution. The truck will then be driven back to the solar pond for the next load.

## 3.0 ACCIDENTS

### 3.1 DRAFT SAFETY ANALYSIS REPORT FOR THE 750 AND 904 PADS

A Draft Safety Analysis Report (SAR) for the 750 and 904 Pads Temporary Pondcrete and Saltcrete Storage Facilities was written with the expected waste form as pondcrete or saltcrete in half triple-wall body package (triwall box), half flush-panel plywood box (half box), full flush-panel plywood box (full box), and corrugated metal waste container (metal crate). The Hazard Classification for the facility was calculated based on a small airplane crash into the facility with the resultant release due to impact, fire, and entrainment release of hazardous chemicals and radionuclides. The facility was designated as Category 3. The total quantity of material involved was $1.71 \times 10^7$ kilograms, with a total 80 kg of pondcrete released into the atmosphere. The chemical composition of the pondcrete was based on the 95th percentile of 19 samples analyzed for a variety of hazardous constituents for pondcrete produced from the 207A Pond.

Three bounding accidents were evaluated in the 750/904 Pads SAR for assessing the consequences of these accidents. They were:

1) A spill of $5.12 \times 10^3$ kg of pondcrete over a five minute period releasing 0.034 kg of material to the atmosphere,

2) A 30 minute fire involving $2.15 \times 10^5$ kg of pondcrete releasing 0.9 kg of material to the atmosphere, and

3) A 2 hour fire involving $1.89 \times 10^6$ kg of pondcrete releasing 7.6 kg of material to the atmosphere.

Table 1 presents a summary of the results for the radiological and chemical hazard analysis calculations from the draft SAR.

### 3.2 EARLY REMEDIATION OF SOLAR PONDS ACCIDENT ANALYSIS

Early remediation of the solar ponds will move the contents of the ponds to tanks installed inside of tents on the 750 Pad. The

total quantity of A/B/C Pond and Clarifier sludge/brine water mixture that will be placed in storage on the 750 Pad is approximately $3.5 \times 10^6$ kg. The sludge or brine/sludge mixtures will occupy a minimum of 71 of the 10000 gallon storage containers.
The aircraft scenario used in the bounding SAR analysis was not repeated for the tanks of sludge. The estimated $3.5 \times 10^6$ kg of total material in the tanks represents approximately 21 percent of the total material inventory (i.e., $1.7 \times 10^7$ kg) assumed to be involved in the aircraft crash and ensuing fire. In addition, unlike pondcrete, the water content of the sludge and brine solution would act to inhibit fire propagation. As a result of the placement of the tanks on the 750 Pad, the actual pondcrete capacity is diminished from that assumed in the SAR analysis, making the SAR analysis more conservative. Therefore, the plane crash into the pondcrete is judged to bound a crash into the tanks.

Two accidents are evaluated in detail for each of three brine/sludge solution types that may be transported to determine if the consequences are within those determined for the bounding accidents presented in the Draft SAR. They are:

1) The spill of the entire contents of one 10000 gallon container inside of the tent structure. This would involve up to $5.9 \times 10^4$ kg of pond sludge releasing 0.11 kg to the atmosphere and

2) The spill of the entire contents of the vacuum truck onto the ground outside of the tent structure. This would involve up to $2 \times 10^4$ kg of pond sludge releasing up to 0.04 kg to the atmosphere.

The three solutions types, for which calculations are made, are pure liquid solution from the 207C Pond, concentrated brine with 5% suspended solids from the 207C Pond, and the brine/sludge mixture from the clarifier.

The results of the hazard analysis calculations are given in Table 1 for comparison with the Draft SAR calculations.

### 3.2.1 WASTE CHARACTERIZATION

Waste characterization for the Accelerated Sludge Removal Program is based on several reports as follows:

1) Pond Sludge Waste Characterization Report and Clarifier Sludge Waste Characterization Report for EG&G Rocky Flats Prepared by Halliburton NUS Environmental Corporation, March 1992

2) Weston Report

3) Options Analysis Report for the Accelerated Sludge Removal Project, Final Report, 234353GG Under MTS 225456RR, Prepared by ICF Kaiser Engineers, Inc. July 26, 1993.

The Weston and Halliburton/NUS chemical characterization data for the 207C Pond was treated together and a single conservative composition was calculated for the brine solution concentration and a single average composition for the sludge. There were no Weston data for the clarifier so the Halliburton/NUS data were used.

### 3.2.2 RELEASE FRACTIONS

Release fractions for the spilling of the material were taken from NUREG/CR-4658, "Aerosols Generated By Spills of Viscous Solutions and Slurries", Prepared by M. Y. Ballinger and W. H. Hodgson, December 1986. A least squares fit of the release fraction as a function of viscosity was performed and the data interpolated at 19 centipoise, the estimated viscosity for 207C Pond solution, and extrapolated to 50 and 400 centipoise, the estimated viscosities of the sludge/brine solution for the 207C Pond and Clarifier respectively. The value used is the calculated value plus two standard deviations, to account for the uncertainty in the calculated fit function, calculated at the appropriate viscosity.

### 3.2.3 ATMOSPHERIC DISPERSION

Local worker exposure assumes that the released material is uniformly contained in 1000 cubic meters of atmosphere for the clarifier brine/sludge mixture. This is about one-third of the free air space in Tent 3 or 4. The draft SAR used 206 $m^3$ for the immediate worker dilution volume for the spill of 4.2 $yd^3$ (850 gallons) of pondcrete, a much smaller volume of material. For the 207C Pond material, the brine solution will be much less viscous and will spread through out the entire tent; therefore the smallest tent free space volume of 3360 $m^3$ will be used.

A collocated worker is assumed to be 100 meters downwind under the most conservative meteorology conditions, F Stability Class with a wind speed of 1 meter/second. The maximum exposed individual off-site is assumed to be 1900 meters with the same meteorology.

In comparison, the draft SAR used 100-200 meter range for the on-site worker and 2000-2100 meter range for the off-site public dose calculations using the MACCS computer code. For the three accident conditions analyzed the draft SAR used D stability class and 4 meters/second wind speed, which is less conservative. However, the draft SAR used F stability class and one meter/second wind speed for the Hazard Classification Calculations.

### 3.2.4 EXPOSURE CALCULATIONS

The aerosolized released fraction of material is assumed to occur instantaneously and persist for 15 minutes, allowing a peak 15 minute average concentration to be calculated. The concentration of each hazardous chemical is then compared to the threshold limit value - time weighted average (TLV-TWA) provided by the American Conference of Governmental Industrial Hygienists (ACGIH). The use of TLV-TWA is conservative for accident analysis purposes and is consistent with the methodology used in the Building 910 hazard classification and SAR, which was approved by DOE. The TLV-TWA limits does not create any limitations for the 750 Pad operations and provides an additional margin of safety.

A safety fraction is calculated as the sum of the ratios of chemical concentration to the TLV-TWA. For public exposure one-tenth of the TLV-TWA was used in the calculation of the safety factor. These values are more conservative than those used in the draft SAR. The on-site worker and the public are assumed to be exposed to the hazardous material at the maximum concentration during the entire plume passage.

Radiological exposure is assumed to occur through inhalation of the radioactive material. The breathing rate for the exposed population from the draft SAR was used. Dose conversion factors were taken for specific radionuclides from the Federal Guidance Report No. 11, Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion. Gross alpha was assumed to be composed of plutonium-239 and gross beta plutonium-241. Exposure was calculated as the committed effective dose equivalent (CEDE).

The results of these exposure calculations are shown in Table 1, Table 2, and Table 3 for the three scenarios evaluated. Table 1 is for the 207C Pond Brine/Sludge mixture. Table 2 is for the Clarifier Brine/Sludge mixture, and Table 3 is for the 207C Pond Solution only. In all cases, the safety fraction or radiation exposure calculated is smaller than the largest value from the Hazard classification or analyzed accident in the Draft SAR. Thus, the storage of the brine/sludge mixtures is within the bounding envelope calculated in the Draft SAR.

## 4.0 CONCLUSIONS

The storage of brine/sludge mixtures from the 207C pond and clarifier in tanks on the 750 Pad is within the safety envelope calculated for the storage of Pondcrete on the 750/904 Pads as presented in the Draft SAR.

TABLE 1

COMPARISON OF DRAFT SAR ACCIDENT ANALYSIS WITH EARLY REMEDIATION OF SOLAR POND HAZARD ANALYSIS
207C Pond Brine/Sludge

| | SAR Hazard Classification | SAR Accidents Evaluated | | | Early Remediation 207C Pond & Clarifier - 750 Pad | |
|---|---|---|---|---|---|---|
| Exposed Individual Hazardous Chemical Radiological | Small Airplane Crash | Fork Lift Spill | 30 Minute Fire | 2 Hour Fire | 10000 Gallon Tank Spill Inside Tent | Truck Spill Outside Tent |
| Worker Toxic Exposure Safety Fraction [1] | N/A | [1] 25.7<br>[2] 0.445 | N/A | N/A | [3] 0.91 | [3] 0.99 |
| Worker Radiation Exposure Rem (CEDE) | N/A | 0.106 | N/A | N/A | $1.2 \times 10^{-3}$ | $4.3 \times 10^{-4}$ |
| On-site Worker Toxic Exposure Safety Fraction [1] | 0.63 | 0.069 | 0.0014 | $2.9 \times 10^{-12}$ | | [3] 0.057 |
| On-site Worker Radiation Exposure Rem (CEDE) | 0.0016 | $6 \times 10^{-6}$ | $3.6 \times 10^{-7}$ | $1 \times 10^{-13}$ | | $8.2 \times 10^{-5}$ |
| Off-site Person Toxic Exposure Safety Fraction [3] | 0.23 | 0.00048 | $8 \times 10^{-5}$ | $4.4 \times 10^{-17}$ | | [4] $2.6 \times 10^{-3}$ |
| Off-site Person Radiation Exposure Rem (CEDE) | .00026 | $1.3 \times 10^{-7}$ | $1.5 \times 10^{-7}$ | $2.8 \times 10^{-16}$ | | $3.8 \times 10^{-7}$ |

Note 1 - Fraction against ERPG2
Note 2 - Fraction against ERPG3
Note 3 - Fraction against ERPG1 (TLV-TWA)
Note 4 - Fraction against 0.1*TLV-TWA

TABLE 2

COMPARISON OF DRAFT SAR ACCIDENT ANALYSIS WITH EARLY REMEDIATION OF SOLAR POND HAZARD ANALYSIS
Clarifier Brine/Sludge

| | SAR Hazard Classification | SAR Accidents Evaluated | | | Early Remediation 207C Pond & Clarifier - 750 Pad | |
|---|---|---|---|---|---|---|
| Exposed Individual Hazardous Chemical Radiological | Small Airplane Crash | Fork Lift Spill | 30 Minute Fire | 2 Hour Fire | 10000 Gallon Tank Spill Inside Tent | Truck Spill Outside Tent |
| Worker Toxic Exposure Safety Fraction [1] | N/A | [1] 25.7<br>[2] 0.445 | N/A | N/A | [3] 0.55 | |
| Worker Radiation Exposure Rem (CEDE) | N/A | 0.106 | N/A | N/A | $1.4 \times 10^{-3}$ | |
| On-site Worker Toxic Exposure Safety Fraction [1] | 0.63 | 0.069 | 0.0014 | $2.9 \times 10^{-12}$ | | [3] $1.8 \times 10^{-3}$ |
| On-site Worker Radiation Exposure Rem (CEDE) | 0.0016 | $6 \times 10^{-6}$ | $3.6 \times 10^{-7}$ | $1 \times 10^{-13}$ | | $2.5 \times 10^{-5}$ |
| Off-site Person Toxic Exposure Safety Fraction [3] | 0.23 | 0.00048 | $8 \times 10^{-5}$ | $4.4 \times 10^{-17}$ | | [4] $4.7 \times 10^{-4}$ |
| Off-site Person Radiation Exposure Rem (CEDE) | .00026 | $1.3 \times 10^{-7}$ | $1.5 \times 10^{-7}$ | $2.8 \times 10^{-16}$ | | $1.2 \times 10^{-7}$ |

Note 1 - Fraction against ERPG2
Note 2 - Fraction against ERPG3
Note 3 - Fraction against ERPG1 (TLV-TWA)
Note 4 - Fraction against 0.1*TLV-TWA

TABLE 3

COMPARISON OF DRAFT SAR ACCIDENT ANALYSIS WITH EARLY REMEDIATION OF SOLAR POND HAZARD ANALYSIS
207C Pond Solution Only

| | SAR Hazard Classification | SAR Accidents Evaluated | | | Early Remediation 207C Pond & Clarifier - 750 Pad | |
|---|---|---|---|---|---|---|
| Exposed Individual Hazardous Chemical Radiological | Small Airplane Crash | Fork Lift Spill | 30 Minute Fire | 2 Hour Fire | 10000 Gallon Tank Spill Inside Tent | Truck Spill Outside Tent |
| Worker Toxic Exposure Safety Fraction [1] | N/A | [1] 25.7<br>[2] 0.445 | N/A | N/A | [3] 1.22 | |
| Worker Radiation Exposure Rem (CEDE) | N/A | 0.106 | N/A | N/A | $5.5 \times 10^{-4}$ | |
| On-site Worker Toxic Exposure Safety Fraction [1] | 0.63 | 0.069 | 0.0014 | $2.9 \times 10^{-12}$ | | [3] 0.076 |
| On-site Worker Radiation Exposure Rem (CEDE) | 0.0016 | $6 \times 10^{-6}$ | $3.6 \times 10^{-7}$ | $1 \times 10^{-13}$ | | $3.4 \times 10^{-5}$ |
| Off-site Person Toxic Exposure Safety Fraction [3] | 0.23 | 0.00048 | $8 \times 10^{-5}$ | $4.4 \times 10^{-17}$ | | [4] $4.9 \times 10^{-3}$ |
| Off-site Person Radiation Exposure Rem (CEDE) | .00026 | $1.3 \times 10^{-7}$ | $1.5 \times 10^{-7}$ | $2.8 \times 10^{-16}$ | | $1.6 \times 10^{-7}$ |

Note 1 - Fraction against ERPG2
Note 2 - Fraction against ERPG3
Note 3 - Fraction against ERPG1 (TLV-TWA)
Note 4 - Fraction against 0.1*TLV-TWA

# NUCLEAR SAFETY ENGINEERING CALCULATION COVER SHEET



Sheet 1 of 23 Sheets

Title Hazard Calculation for Remediation of 207C Pond and Clarifier

Building 207C Solar Pond / 750 Pad

Project Work Package 12188 Calculation No. 94-SAE-001

Analyzed System _____ Supersedes Calculation No. _____

References _____

If Superseded, Give Superseding Calculation Number _____

Calculation Objective/Summary Description

Provide a Safety Analysis for the Accelerated Solar Pond Sludge and Liquor Removal and Storage in Tanks for the 207C Pond and Clarifier.

Computer Code

Dated Program Version _____

Operating System _____

Hardware Configuration _____

| Rev. No. | Revision | Originator | Date | Checked By | Date | Approved By | Date |
|---|---|---|---|---|---|---|---|
| 0 | Original | [illegible] | 1/13/94 | [illegible] | 1/13/94 | Don Swanson | 1/20/94 |
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# NUCLEAR SAFETY ENGINEERING CALCULATION
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By A. C. Stalk Date 1/7/94 Sheet 2 of 23 Sheets

Calculation No. 94-SAE-001

Checked By [illegible] Date 1-13-94 Revision No. 0


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Additional Comments

Subject Hazard Calculation for Remediation of 207C Pond and Clarifier
By A C Stulken Date 1/7/94 Chk. By B S Rayfed Date 1-13-94 Orig. ☒ Rev. ☐

1. Object of Calculation

The object of the calculation is to combine the Hallburton/NUS and Weston analytical data for the solar pond 207C sludge and liquid analysis and for the clairifyer data, (NUS only). Calculate the hazard for storing the sludge and liquid material in 10000 gallon tanks on the 750 Pond. These results will be compared to the 750 draft SAR accident calculation.

2. Methodology

a. Combine the Weston and Hallburton/NUS analytical data for both the sludge and liquid in the 207C Pond. The data are as follows:

1. ~~Sludge~~ Liquid

Weston 1 composite sample from 4 quadrants
NUS 5 Quadrants sample (1 duplicate from NE)

NUS Calculate an average from the 5 samples
((NE + NE dup)/2 + NW + SE + SW)/4

Calculate an average value from (NUS + weston)/2 for each analyte. When one value is missing will use the other at its value.

A conservative concentration value is based on the largest single measurement in any of the six samples.

These calculations are found in EXCELL Spreadsheet 207CH20.XLS. Hard copy is page 5 through 7 of this calculation.

2. Sludge

Weston 4 quadrant sample - 1 composite of 4 quadrants.

Subject Hazard Calculation for Remediation of 207C Pond and Clarifier
By A.C. Stalker Date 1/7/94 Chk. By G.S. Rapid Date 1-13-94 Orig. ☒ Rev. ☐

2.2.2. cont'

NUS 1 four quadrant composite, 1 berm sample, 3 quadrant samples (NW, NW dup & SW)

Averages calculated for each company.

Weston ((NW + SW + NE + SE)/4 + composite)/2

NUS (((NW + NWD)/2 + SW)/2 + composite)/2

NUS Data found in EXCEL SPREADSHEET NUSCSLG.XLS
Hard copy is pages 8 - 10 of this calculation

Weston Data found in EXCEL SPREADSHEET 207CSLG.XLS
Hard copy is pages 11 - 15 of this calculation.

A best estimate average value was calculated as (Weston + NUS)/2 for those cases where both vendors reported a value. For those ~~cases~~ analytes where only one vendor reported, that concentration was used. EXCEL FILE 207CSLG.XLS.

b. The only analytical data for the clarifier was done by Halliburton/NUS.

1. Liquid - Three sample locations with one duplicate were analyzed. An average value was calculated as ((001 + 001 dup)/2 + 002 + 003)/3 A conservative value estimate used the highest value for an analyte. EXCEL FILE 207CH20.XLS

2. Sludge - Three sample locations with one duplicate were analyzed. An average value was calculated as ((001 + 001 dup)/2 + 002 + 003)/3 EXCEL FILE NUSCSLG.XLS.

NEXT TEXT ON PAGE 16

Hazard Calculation For Remediation of 207C Pond and Clarifier. By [signature] Date 1/13/94 CHK. By [signature] Date [illegible] Calc. No. 94-SAE-001 Sheet 5 of 23 Sheets

| | 207 C Solar Pond Water Sample Analytical Data | | | | | Detection Limit Values are BOLD numbers | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Less than multiplier = 1 | | | | | Halliburton | | |
| | | Halliburton - NUS Samples | | | | | NUS | Weston | 207C Pond |
| | | PW207C-NE | PW207C-NED | PW207C-NW | PW207C-SE | PW207C-SW | Average | 207 C | Average |
| Analyte | Mole wt | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| 2-Butanone | 72.12 | 0.11 | 0.077 | 0.11 | 0.01 | 0.079 | 7.31E-02 | | 7.31E-02 |
| Ag | 107.87 | | | | | | | | |
| As | 74.92 | 4.11 | 3.37 | 3.55 | 3.35 | 4.07 | 3.68E+00 | 1 | 2.34E+00 |
| B as B(OH)4 | 78.84 | 3.35E+03 | 3.60E+03 | 3.19E+03 | 3.19E+03 | 3.53E+03 | 3.35E+03 | 2.62E+03 | 2.99E+03 |
| Ba | 137.33 | 0.13 | 0.11 | 0.13 | 0.13 | 0.15 | 1.33E-01 | | 1.33E-01 |
| Cd | 112.41 | 0.49 | 0.43 | 0.45 | 0.5 | 0.56 | 4.93E-01 | 0.312 | 4.02E-01 |
| Cr | 52 | 3.58 | 3.4 | 3.37 | 3.32 | 3.94 | 3.53E+00 | 2.36 | 2.95E+00 |
| Cu | 63.546 | | | | | | | 6.79 | 6.79E+00 |
| Hg | 200.59 | | | | | | | | |
| Pb | 207.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 3.00E-01 | 0.3 | 3.0E-01 |
| Mg | 24.305 | 2.97 | 1.3 | 2.95 | 2.85 | 3.87 | 2.95E+00 | | 2.95E+00 |
| Ni | 58.71 | 2.61 | 2.92 | 2.56 | 2.54 | 2.79 | 2.66E+00 | 5.09 | 3.88E+00 |
| K | 39.0983 | 55200 | 59200 | 55200 | 54700 | 54500 | 5.54E+04 | 78700 | 6.71E+04 |
| Se | 78.96 | 0.6 | 6 | 3 | 3 | 0.6 | 2.48E+00 | 0.5 | 1.49E+00 |
| Si | 28.0855 | | | | | | | 30.1 | 3.01E+01 |
| Na | 22.99 | 138000 | 142000 | 137000 | 136000 | 136000 | 1.37E+05 | 102000 | 1.20E+05 |
| Zn | 65.39 | | | | | | | 2 | 2.00E+00 |
| NH3 | 17 | 5 | 6.4 | 1.9 | 1.8 | 3.6 | 3.25E+00 | | 3.25E+00 |
| Cl- | 35.4527 | 21000 | 24000 | 25000 | 22000 | 23000 | 2.31E+04 | 18300 | 2.07E+04 |
| F- | 18.998 | | | | | | | 1470 | 1.47E+03 |
| NO2- | 46 | | | | | | | 8225 | 8.23E+03 |
| NO3- | 62 | 65000 | 66000 | 57000 | 62000 | 62000 | 6.16E+04 | 11518 | 3.66E+04 |
| CN | 26 | 3.3 | 20 | 4 | 7.1 | 4.1 | 6.71E+00 | 9.65 | 8.18E+00 |
| SO4- | 96 | 17000 | 17000 | 18000 | 16000 | 17000 | 1.70E+04 | 12200 | 1.46E+04 |
| CO3- | 60 | | | | | | | 25000 | 2.50E+04 |
| HCO3- | 61 | | | | | | | 4000 | 4.00E+03 |
| TOC | | 1300 | 1600 | 1300 | 1200 | 1400 | 1.34E+03 | 54.9 | 6.96E+02 |
| P | 30.97 | 570 | 610 | 520 | 560 | 570 | 5.60E+02 | 431 | 4.96E+02 |
| Total | | 3.01E+05 | 3.14E+05 | 2.97E+05 | 2.96E+05 | 2.98E+05 | 3.00E+05 | 2.65E+05 | 3.01E+05 |
| Sum of Fraction | | | | | | | | | |
| pH | | 10 | 10.1 | 10.1 | 10.1 | 10.1 | 10.09 | 10.2 | 10.14 |
| TDS | | 510000 | 500000 | 470000 | 500000 | 300000 | 4.44E+05 | 400000 | 4.22E+05 |
| S Gravity | | 1.348 | 1.348 | 1.318 | 1.33 | 1.316 | 1.328 | 1.328 | 1.328 |
| | | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L |
| G Alpha | | 63000 | 84000 | 98000 | 130000 | 120000 | 1.05E+05 | 7.20E+04 | 8.87E+04 |
| G Beta | | 170000 | 190000 | 180000 | 200000 | 230000 | 1.98E+05 | 1.70E+05 | 1.84E+05 |
| U 234 | | | | | | | | 2.60E+03 | 2.60E+03 |
| U 235 | | | | | | | | 1.20E+02 | 1.20E+02 |
| U 238 | | | | | | | | 3.90E+03 | 3.90E+03 |
| Am 241 | | | | | | | | 8.6 | 8.60E+00 |
| Pu 239 | | | | | | | | 6.70E+02 | 6.70E+02 |

Excell File 207CH20.XLS

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Hazard Calculation For Remediation of 207C Pond and Clarifier. By [illegible] Date 1/12/94 CHK. By [illegible] Date [illegible] Calc. No. 94-SAF-001 Sheet 6 of 23 Sheets

| | | Release Fraction = | 4.10E-06 | | | | X/Q (s/m3) | | X/Q (s/m3) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 10000 gal Tank | Worker | | | 3232 | 5.1[illegible]E-02 | Co-located | 2.36E-04 | |
| | Conservative | Conservative | Conservative | Worker | | Gallon Spill | Co-located | Worker | Maximum | MOI |
| | Estimate | Estimate | Release | Safety | | Truck release | Worker | Safety | Off-site | Safety |
| | 207C Pond | 207C Pond | 207C Pond | Factor | | 207C Pond | Exposure | Factor | Individual | Factor |
| Analyte | mg/L | KG | mg/m3 | exp/TLV-TWA | | mg | mg/m3 | exp/TLV-TWA | mg/m3 | exp/(0.1*TWA) |
| 2-Butanone | 1.10E-01 | 4.16E-03 | 5.08E-06 | 8.61E-09 | | 5.52E-03 | 3.1[illegible]E-07 | 5.35E-10 | 1.45E-09 | 2.45E-11 |
| Ag | | 0.00E+00 | 0.00E+00 | 0.00E+00 | | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| As | 4.11E+00 | 1.56E-01 | 1.90E-04 | 9.49E-04 | | 2.06E-01 | 1.1[illegible]E-05 | 5.90E-05 | 5.41E-08 | 2.70E-06 |
| B as B(OH)4- | 3.60E+03 | 1.36E+02 | 1.66E-01 | 1.66E-01 | | 1.81E+02 | 1.0[illegible]E-02 | 1.03E-02 | 4.74E-05 | 4.74E-04 |
| Ba | 1.50E-01 | 5.68E-03 | 6.93E-06 | 1.39E-05 | | 7.52E-03 | 4.31E-07 | 8.61E-07 | 1.97E-09 | 3.95E-08 |
| Cd | 5.60E-01 | 2.12E-02 | 2.59E-05 | 5.17E-04 | | 2.81E-02 | 1.6[illegible]E-06 | 3.21E-05 | 7.37E-09 | 1.47E-06 |
| Cr | 3.94E+00 | 1.49E-01 | 1.82E-04 | 3.64E-03 | | 1.98E-01 | 1.1[illegible]E-05 | 2.26E-04 | 5.18E-08 | 1.04E-05 |
| Cu | 6.70E+00 | 2.57E-01 | 3.14E-04 | 3.14E-04 | | 3.41E-01 | 1.9[illegible]E-05 | 1.95E-05 | 8.93E-08 | 8.93E-07 |
| Hg | | 0.00E+00 | 0.00E+00 | 0.00E+00 | | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Pb | 3.00E-01 | 1.14E-02 | 1.39E-05 | 9.28E-05 | | 1.50E-02 | 8.61E-07 | 5.74E-06 | 3.95E-09 | 2.63E-07 |
| Mg | 3.87E+00 | 1.46E-01 | 1.79E-04 | 1.79E-05 | | 1.94E-01 | 1.11E-05 | 1.11E-06 | 5.09E-08 | 5.09E-08 |
| Ni | 5.09E+00 | 1.93E-01 | 2.35E-04 | 2.35E-01 | | 2.55E-01 | 1.46E-05 | 1.46E-05 | 6.70E-08 | 6.70E-07 |
| K | 7.87E+04 | 2.98E+03 | 3.64E+00 | 3.64E-01 | | 3.95E+03 | 2.26E-01 | 2.26E-02 | 1.04E-03 | 1.04E-03 |
| Se | 6.00E+00 | 2.27E-01 | 2.77E-04 | 1.39E-03 | | 3.01E-01 | 1.7[illegible]E-05 | 8.61E-05 | 7.89E-08 | 3.95E-06 |
| Si | 3.01E+01 | 1.14E+00 | 1.39E-03 | 1.39E-04 | | 1.51E+00 | 8.6[illegible]E-05 | 8.64E-06 | 3.96E-07 | 3.96E-07 |
| Na | 1.42E+05 | 5.38E+03 | 6.56E+00 | 6.56E-01 | | 7.12E+03 | 4.08E-01 | 4.08E-02 | 1.87E-03 | 1.87E-03 |
| Zn | 2.00E+00 | 7.57E-02 | 9.24E-05 | 9.24E-06 | | 1.00E-01 | 5.74E-06 | 5.74E-07 | 2.63E-08 | 2.63E-08 |
| NH3 | 6.40E+00 | 2.42E-01 | 2.96E-04 | 1.74E-05 | | 3.21E-01 | 1.8[illegible]E-05 | 1.08E-06 | 8.42E-08 | 4.95E-08 |
| Cl- | 2.50E+04 | 9.46E+02 | 1.15E+00 | 0.00E+00 | | 1.25E+03 | 7.1[illegible]E-02 | 0.00E+00 | 3.29E-04 | 0.00E+00 |
| F- | 1.47E+03 | 5.56E+01 | 6.79E-02 | 2.72E-02 | | 7.37E+01 | 4.2[illegible]E-03 | 1.69E-03 | 1.93E-05 | 7.73E-05 |
| NO2- | 8.23E+03 | 3.11E+02 | 3.80E-01 | 0.00E+00 | | 4.13E+02 | 2.3[illegible]E-02 | 0.00E+00 | 1.08E-04 | 0.00E+00 |
| NO3 | 6.60E+04 | 2.50E+03 | 3.05E+00 | 0.00E+00 | | 3.31E+03 | 1.8[illegible]E-01 | 0.00E+00 | 8.68E-04 | 0.00E+00 |
| Cl | 2.00E+01 | 7.57E-01 | 9.24E-04 | 1.85E-04 | | 1.00E+00 | 5.74E-05 | 1.15E-05 | 2.63E-07 | 5.26E-07 |
| SO4 | 1.80E+04 | 6.81E+02 | 8.31E-01 | 0.00E+00 | | 9.03E+02 | 5.1[illegible]E-02 | 0.00E+00 | 2.37E-04 | 0.00E+00 |
| CO3 | 2.50E+04 | 9.46E+02 | 1.15E+00 | 0.00E+00 | | 1.25E+03 | 7.1[illegible]E-02 | 0.00E+00 | 3.29E-04 | 0.00E+00 |
| HCO3- | 4.00E+03 | 1.51E+02 | 1.85E-01 | 0.00E+00 | | 2.01E+02 | 1.1[illegible]E-02 | 0.00E+00 | 5.26E-05 | 0.00E+00 |
| TOC | 1.60E+03 | 6.06E+01 | 7.39E-02 | 0.00E+00 | | 8.03E+01 | 4.59E-03 | 0.00E+00 | 2.10E-05 | 0.00E+00 |
| P | 6.10E+02 | 2.31E+01 | 2.82E-02 | 0.00E+00 | | 3.06E+01 | 1.7[illegible]E-03 | 0.00E+00 | 8.02E-06 | 0.00E+00 |
| Total | 3.74E+05 | 1.42E+04 | 1.73E+01 | 1.73E+00 | | 1.88E+04 | 1.07E+00 | 1.07E-01 | 4.92E-03 | 4.92E-03 |
| Sum of Fraction | | | | 1.22E+00 | | | | 7.58E-02 | | 3.48E-03 |
| pH | 10.20 | | | | | | | | | |
| TDS | 5.10E+05 | | | | | | | | | |
| S Gravity | 1.348 | | | | | | | | | |
| | Gallons | 1.00E+04 | 3360 | m3 volume | | | | | | |
| | pCi/L | Curies | uCi/cc | Rem (CEDE) | | Curies | uCi/cc | Rem (CEDE) | uCi/cc | Rem (CEDE) |
| G Alpha | 1.30E+05 | 4.92E-03 | 6.00E-12 | 5.37E-04 | | 6.52E-09 | 3.73E-13 | 3.34E-05 | 1.71E-15 | 1.53E-07 |
| G Beta | 2.30E+05 | 8.71E-03 | 1.06E-11 | 1.82E-05 | | 1.15E-08 | 6.60E-13 | 1.13E-06 | 3.03E-15 | 5.19E-09 |
| U-234 | 2.60E+03 | 9.84E-05 | 1.20E-13 | 1.97E-07 | | 1.30E-10 | 7.46E-15 | 1.22E-08 | 3.42E-17 | 5.61E-11 |
| U-235 | 1.20E+02 | 4.54E-06 | 5.54E-15 | 8.41E-09 | | 6.02E-12 | 3.44E-16 | 5.23E-10 | 1.58E-18 | 2.40E-12 |
| U-238 | 3.90E+03 | 1.48E-04 | 1.80E-13 | 2.63E-07 | | 1.96E-10 | 1.12E-14 | 1.63E-08 | 5.13E-17 | 7.48E-11 |
| Am-241 | 8.60E+00 | 3.26E-07 | 3.97E-16 | 3.66E-08 | | 4.31E-13 | 2.47E-17 | 2.27E-09 | 1.13E-19 | 1.04E-11 |
| Pu-239 | 6.70E+02 | 2.54E-05 | 3.09E-14 | 2.77E-05 | | 3.36E-11 | 1.92E-15 | 1.72E-07 | 8.81E-18 | 7.88E-10 |

Detection Limit Values are BOLD numbers

| Analyte | CW-001 mg/L | Halliburton - NUS Clarifier Analytical Data CW 001D mg/L | CW-002 mg/L | CW-003 mg/L | Clarifier Average mg/L | Conservative Estimate Clarifier mg/L | 56781 Liters Clarifier Liquid KG | TLV-TWA mg/m3 | |
|---|---|---|---|---|---|---|---|---|---|
| 2-Butanone | | | | | | | | 590 | |
| Ag | 0.066 | 0.11 | 0.072 | 0.091 | 8.37E-02 | 1.10E-01 | 6.25E-03 | 0.01 | as Ag |
| As | 0.342 | 0.272 | 0.334 | 0.302 | 3.14E-01 | 3.42E-01 | 1.94E-02 | 0.2 | as As |
| B as B(OH)4- | 1.74E+02 | 1.70E+02 | 2.20E+02 | 2.53E+02 | 2.15E+02 | 2.53E+02 | 1.44E+01 | 1 | as borate |
| Ba | 0.044 | 0.091 | 0.03 | 0.032 | 4.32E-02 | 9.10E-02 | 5.17E-03 | 0.5 | as Ba |
| Cd | 0.231 | 0.57 | 0.038 | 0.043 | 1.61E-01 | 5.70E-01 | 3.24E-02 | 0.05 | as Cd |
| Cr | 0.283 | 0.825 | 0.138 | 0.175 | 2.89E-01 | 8.25E-01 | 4.68E-02 | 0.05 | as Cr(VI) |
| Cu | | | | | | | | 1 | as Cu dust & mist |
| Hg | 0.0022 | 0.0038 | 0.0035 | 0.0046 | 3.70E-03 | 4.60E-03 | 2.61E-04 | 0.01 | as Hg skin & alkyl cmpds |
| Pb | 0.034 | 0.046 | 0.03 | 0.03 | 3.33E-02 | 4.60E-02 | 2.61E-03 | 0.15 | as Pb inorg dust & fume |
| Mg | 3.27 | 6.73 | 2.58 | 3.02 | 3.53E+00 | 6.73E+00 | 3.82E-01 | 10 | MgO fume |
| Ni | 0.258 | 0.393 | 0.293 | 0.335 | 3.18E-01 | 3.93E-01 | 2.23E-02 | 1 | as Ni insoluble cmpds |
| K | 4930 | 4860 | 6090 | 7000 | 6.00E+03 | 7.00E+03 | 3.97E+02 | 10 | PNOC |
| Se | | | | | | | | 0.2 | as Se |
| Si | | | | | | | | 10 | precipitated silica |
| Na | 10200 | 9940 | 12800 | 14800 | 1.26E+04 | 1.48E+04 | 8.40E+02 | 10 | PNOC |
| Zn | | | | | | | | 10 | as ZnO dust |
| NH3 | 8.5 | 5 | 9.8 | 14 | 1.02E+01 | 1.40E+01 | 7.95E-01 | 17 | as NH3 |
| Cl- | 1600 | 1700 | 3200 | 1850 | 2.23E+03 | 3.20E+03 | 1.82E+02 | | |
| F- | | | | | | | | 2.5 | as F, fluorides |
| NO2- | | | | | | | | | |
| NO3 | 10000 | 5700 | 6900 | 6400 | 7.05E+03 | 1.00E+04 | 5.68E+02 | | |
| CN- | 2.4 | 2.7 | 2.8 | 3 | 2.78E+00 | 3.00E+00 | 1.70E-01 | 5 | as CN |
| SO4-- | 3200 | 2600 | 2800 | 2600 | 2.77E+03 | 3.20E+03 | 1.82E+02 | | |
| CO3 | | | | | | | | | |
| HCO3 | | | | | | | | | |
| TOC | 190 | 140 | 160 | 170 | 1.65E+02 | 1.90E+02 | 1.08E+01 | | |
| P | 84 | 80 | 78 | 81 | 8.03E+01 | 8.40E+01 | 4.77E+00 | | |
| Total | 3.04E+04 | 2.52E+04 | 3.23E+04 | 3.32E+04 | 3.11E+04 | 3.88E+04 | 2.20E+03 | 10 | PNOC |
| Sum of Fraction | | | | | | | | | |
| pH | 10 | 10 | 10 | 9.9 | 9.97 | 10.00 | | | |
| TDS | 46000 | 61000 | 60000 | 68000 | 6.05E+04 | 6.80E+04 | | | |
| S Gravity | 1.038 | | 1.040 | 1.044 | 1.041 | 1.044 | | | |
| | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L | Curies | CEDE Rem/Ci | |
| G-Alpha | 16000 | 19000 | 18000 | 16000 | 1.72E+04 | 1.90E+04 | 1.08E-03 | 4.30E+08 | Assumes all Pu-239 |
| G-Beta | 23000 | 22000 | 26000 | 30000 | 2.62E+04 | 3.00E+04 | 1.70E-03 | 8.25E+06 | Assumes all Pu-241 |
| U-234 | | | | | | | | 7.89E+06 | Inhalation Class W |
| U-235 | | | | | | | | 7.30E+06 | Inhalation Class W |
| U-238 | | | | | | | | 7.01E+06 | Inhalation Class W |
| Am-241 | | | | | | | | 4.43E+08 | Inhalation Class W |
| Pu-239 | | | | | | | | 4.30E+08 | Inhalation Class W |

Halliburton/NUS Sludge Data

Less than multiplyer = 1.0

| Analyte | Composite PS207C mg/kg | Composite Berm 207C mg/kg | PS207C-NW mg/kg | PS207C NWD mg/kg | PS207C-SW mg/kg | Average PS207C mg/kg | Average PS207C KG | CS-001 mg/kg | CS-001D mg/kg |
|---|---|---|---|---|---|---|---|---|---|
| 1,1,1 Trichloroethane | | | | | | | | 0.026 | 0.009 |
| 2-Butanone | 0.016 | 0.074 | 0.16 | 0.16 | 0.14 | 8.30E-02 | 2.22E-02 | 0.18 | 0.092 |
| Benzene | 0.007 | | | | 0.031 | 7.00E-03 | 1.87E-03 | | |
| Trichlorotrifluoroethane | | | | | | | | 0.1 | 0.073 |
| Tetrachloroethylene | 0.011 | 0.073 | 0.009 | 0.008 | 0.01 | 1.01E-02 | 2.71E-03 | 1 | 0.28 |
| Trichloroethylene | | | | 0.007 | 0.005 | 6.00E-03 | 1.60E-03 | | 0.007 |
| Pyrene | 0.19 | 0.32 | | | | 1.90E-01 | 5.08E-02 | | |
| Arsenic | 23.9 | 35 | 37 | 18 | 26.2 | 2.54E+01 | 4.08E+00 | 21.9 | 13.5 |
| Barium | 23 | 61.5 | 13.2 | 32.2 | 25.2 | 2.35E+01 | 3.77E+00 | 217 | 94.8 |
| Boron as B(OH)4- | 3.32E+03 | 5.05E+03 | 4.33E+03 | 5.69E+03 | 3.91E+03 | 3.99E+03 | 6.25E+02 | 5.01E+03 | 3.06E+03 |
| Cadmium | 67.3 | 665 | 28.9 | 31.8 | 27.3 | 4.81E+01 | 7.72E+00 | 4660 | 2010 |
| Calcium | | | | | | | | | |
| Chromium | 572 | 960 | 252 | 718 | 586 | 5.54E+02 | 8.90E+01 | 2640 | 1180 |
| Lead | 12.9 | 38.5 | 7.9 | 19.1 | 18.4 | 1.44E+01 | 2.32E+00 | 182 | 83 |
| Magnesium | 2410 | 6250 | 1340 | 3690 | 3160 | 2.62E+03 | 4.22E+02 | 24200 | 10400 |
| Mercury | 1 | 1 | 0.8 | 0.8 | 0.7 | 8.75E-01 | 1.41E-01 | 5 | 5.3 |
| Nickel | 33.6 | 146 | 17.4 | 30.5 | 34.2 | 3.13E+01 | 5.04E+00 | 738 | 339 |
| Potassium | 87200 | 64500 | 82000 | 81200 | 75700 | 8.29E+04 | 1.33E+04 | 62300 | 28700 |
| Silver | 58.6 | 73.6 | 35.1 | 54.1 | 49.2 | 5.28E+01 | 8.48E+00 | 156 | 64.6 |
| Sodium | 144000 | 150000 | 19300 | 162000 | 139000 | 1.29E+05 | 2.08E+04 | 84000 | 39200 |
| Ammonia | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 1.00E-02 | 1.61E-03 | 84 | 64 |
| CN- | 13 | 14 | 170 | 150 | 14 | 5.00E+01 | 8.03E+00 | 25 | 21 |
| Cl- | 14800 | 14600 | 13200 | 19800 | 15000 | 1.53E+04 | 2.45E+03 | 3200 | 3200 |
| HO3- | 220000 | 178000 | 200000 | 200000 | 200000 | 2.10E+05 | 3.37E+04 | 8200 | 9000 |
| SO4- | 26000 | 17600 | 18800 | 16200 | 18000 | 2.19E+04 | 3.51E+03 | 4200 | 4400 |
| Total Organic Carbon | 9000 | 8800 | 6400 | 7300 | 7200 | 8.01E+03 | 1.29E+03 | 3500 | 6200 |
| Total | 5.08E+05 | 4.47E+05 | 3.46E+05 | 4.97E+05 | 4.63E+05 | 4.75E+05 | 7.63E+04 | 2.03E+05 | 1.08E+05 |
| Sum of Fraction = TDS | | | | | | | | | |
| Moisture - Gravimetric % | 34.8 | 46.5 | 48.4 | 48.8 | 41.3 | 39.9 | 1.07E+05 | 69 | 33.1 |
| Moisture - Karl Fisher % | | | | | | | | | |
| Specific Gravity | | | | | | 1.82E+00 | | | |
| | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | Curies | pCi/g | pCi/g |
| Gross Alpha - pCi/g | 4500 | 5900 | 2700 | 3100 | 8700 | 5.15E+03 | 8.27E-01 | 6600 | 6300 |
| Gross Beta - pCi/g | 660 | 810 | 470 | 420 | 1200 | 7.41E+02 | 1.19E-01 | 780 | 860 |
| Volume in Liters | | | | | | 1.47E+05 | | | |
| Sludge Dry Weight, KG | | | | | | 1.61E+05 | | | |
| Sludge Weight KG | | | | | | 2.67E+05 | 1.83E+05 | | |
| Sludge Volume gallons | | | | | | 38788 | | | |
| # of 10000 gallon tanks | | | | | | 4 | | | |

Hazard Calculation For Remediation of 207C Pond and Clarifier. By [illegible] Date 1/13/94 CHK. By [illegible] Date [illegible] Calc. No. 94 SAE 001 Sheet 9 of 23 Sheets

| Analyte | CS 002 mg/kg | CS 003 mg/kg | Average Clarifier Sludge mg/kg | Average Clarifier Sludge KG | Clarifier Liquid mg/L | Clarifier Liquid KG | Clarifier Total KG | Release Fraction = 3.85E-07 Clarifier 10,000 Gallon Release mg | Clarifier Release Worker mg/m3 |
|---|---|---|---|---|---|---|---|---|---|
| 1,1,1-Trichloroethane | 0.018 | 0.029 | 2.15E-02 | 1.30E-03 | | | 1.30E-03 | 1.86E-04 | 1.86E-07 |
| 2-Butanone | 0.037 | 0.13 | 1.18E-01 | 7.10E-03 | | | 7.10E-03 | 1.02E-03 | 1.02E-06 |
| Benzene | | | | | | | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Trichlorotrifluoroethane | 0.045 | 0.15 | 9.38E-02 | 5.66E-03 | | | 5.66E-03 | 8.11E-04 | 8.11E-07 |
| Tetrachloroethylene | 0.32 | 0.83 | 5.97E-01 | 3.60E-02 | | | 3.60E-02 | 5.15E-03 | 5.15E-06 |
| Trichloroethylene | | | 7.00E-03 | 4.23E-04 | | | 4.23E-04 | 6.05E-05 | 6.05E-08 |
| Pyrene | | | | | | | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Arsenic | 14.5 | 12.5 | 1.49E+01 | 3.25E-01 | 0.342 | 1.[illegible]4E-02 | 3.45E-01 | 4.94E-02 | 4.94E-05 |
| Barium | 215 | 207 | 1.93E+02 | 4.21E+00 | 0.091 | 5.17E-03 | 4.21E+00 | 6.03E-01 | 6.03E-04 |
| Boron as B(OH)4 | 8.97E+03 | 1.01E+04 | 7.69E+03 | 1.68E+02 | 253 | 1.41E+01 | 1.82E+02 | 2.61E+01 | 2.61E-02 |
| Cadmium | 3630 | 4280 | 3.77E+03 | 8.23E+01 | 0.57 | 3.[illegible]4E-02 | 8.23E+01 | 1.18E+01 | 1.18E-02 |
| Calcium | | | | | | | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Chromium | 3120 | 2900 | 2.67E+03 | 5.82E+01 | 0.825 | 4.[illegible]9E-02 | 5.83E+01 | 8.34E+00 | 8.34E-03 |
| Lead | 191 | 187 | 1.70E+02 | 3.72E+00 | 4.60E-02 | 2.[illegible]1E-03 | 3.72E+00 | 5.32E-01 | 5.32E-04 |
| Magnesium | 23300 | 24100 | 2.16E+04 | 4.71E+02 | 6.73 | 3.[illegible]2E-01 | 4.71E+02 | 6.75E+01 | 6.75E-02 |
| Mercury | 12 | 14 | 1.04E+01 | 2.27E-01 | 4.60E-03 | 2.[illegible]1E-04 | 2.27E-01 | 3.25E-02 | 3.25E-05 |
| Nickel | 902 | 822 | 7.54E+02 | 1.65E+01 | 0.393 | 2.[illegible]3E-02 | 1.65E+01 | 2.36E+00 | 2.36E-03 |
| Potassium | 67900 | 57100 | 6.02E+04 | 1.31E+03 | 7000 | 3.97E+02 | 1.71E+03 | 2.45E+02 | 2.45E-01 |
| Silver | 153 | 166 | 1.43E+02 | 3.12E+00 | 0.11 | 6.[illegible]5E-03 | 3.13E+00 | 4.48E-01 | 4.48E-04 |
| Sodium | 95300 | 26300 | 8.46E+04 | 1.85E+03 | 1.48E+04 | 8.40E+02 | 2.69E+03 | 3.85E+02 | 3.85E-01 |
| Ammonia | 28 | 71 | 5.77E+01 | 1.26E+00 | 14 | 7.95E-01 | 2.05E+00 | 2.94E-01 | 2.94E-04 |
| CN- | 100 | 110 | 1.08E+02 | 2.35E+00 | 3 | 1.70E-01 | 2.52E+00 | 3.61E-01 | 3.61E-04 |
| Cl- | 3600 | 3400 | 3.40E+03 | 7.42E+01 | 3200 | 1.8[illegible]E+02 | 2.56E+02 | 3.66E+01 | 3.66E-02 |
| NO3 | 8800 | 8400 | 8.60E+03 | 1.88E+02 | 1.00E+04 | 5.6[illegible]E+02 | 7.56E+02 | 1.08E+02 | 1.08E-01 |
| SO4 | 5200 | 5600 | 5.03E+03 | 1.10E+02 | 3.20E+03 | 1.8[illegible]E+02 | 2.92E+02 | 4.17E+01 | 4.17E-02 |
| Total Organic Carbon | 4[illegible]0 | 6400 | 5.28E+03 | 1.15E+02 | 190 | 1.03E+01 | 1.26E+02 | 1.81E+01 | 1.81E-02 |
| Total | 2.[illegible]2E+05 | 2.20E+05 | 2.04E+05 | 4.46E+03 | 3.87E+04 | 2.2[illegible]E+03 | 6.66E+03 | 9.53E+02 | 9.53E-01 |
| Sum of Fraction | | | | | | | | | |
| TDS | | | | | 6.80E+04 | | | | |
| Moisture - Gravimetric % | 7[illegible]5 | 6[illegible]9 | 63.8 | 3.8[illegible]+04 | | | | | |
| Moisture - Karl Fisher % | | | | | | | | | |
| Specific Gravity | | | 1.34 | | 1.044 | | | | |
| | uCi/g | pCi/g | pCi/g | Curies | pCi/L | Curies | Curies | Curies | uCi/cc |
| Gross Alpha pCi/g | 3400 | 4700 | 4.85E+03 | 1.06E-01 | 1.90E+04 | 1.08E-03 | 1.07E-01 | 1.53E-08 | 1.53E-11 |
| Gross Beta pCi/g | 540 | 600 | 6.53E+02 | 1.43E-02 | 3.00E+04 | 1.70E-03 | 1.60E-02 | 2.29E-09 | 2.29E-12 |
| Volume in Liters | | | 4.50E+04 | | 5.68E+04 | | 1.02E+05 | Volume (m3) = | 1000 |
| Sludge Dry Weight, KG | | | 2.18E+04 | | | | | | |
| Sludge Weight KG | | | 6.04E+04 | 4.30E+04 | | | | | |
| Sludge Volume gallons | | | 11900 | | 15000 | | | | |
| # of 10000 gallon tanks | | | 2 | | 2 | | 3 | | |

Excel file NUSCSLG.XLS

1/12/94

Enclosure 1
SRK-022-94
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| Analyte | Worker Safety Factor exp/TLV-TWA | | X/Q (s/m3) = Clarifier Truck, 3232 Gallon release mg | Co-located Worker Exposure mg/m3 | Co-located Worker Safety Factor exp/TLV-TWA | Maximum Off-site Individual mg/m3 | MOI Safety Factor exp/(0.1*TWA) | TLV-TWA mg/m3 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 5.15E-02 | 2.36E-04 | | | | | |
| 1,1,1-Trichloroethane | 9.72E-11 | | 6.00E-05 | 3.44E-09 | 1.80E-12 | 1.57E-11 | 8.24E-14 | 1910 | |
| 2 Butanone | 1.72E-09 | | 3.29E-04 | 1.88E-08 | 3.19E-11 | 8.62E-11 | 1.46E-12 | 590 | |
| Benzene | 0.00E+00 | | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 32 | |
| Trichlorotrifluoroethane | 1.06E-10 | | 2.62E-04 | 1.50E-08 | 1.95E-12 | 6.87E-11 | 8.96E-14 | 7670 | |
| Tetrachloroethylene | 1.52E-08 | | 1.67E-03 | 9.53E-08 | 2.81E-10 | 4.37E-10 | 1.29E-11 | 339 | |
| Trichloroethylene | 2.25E-10 | | 1.95E-05 | 1.12E-09 | 4.16E-12 | 5.13E-12 | 1.91E-13 | 269 | |
| Pyrene | 0.00E+00 | | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Arsenic | 2.47E-04 | | 1.60E-02 | 9.13E-07 | 4.56E-06 | 4.18E-09 | 2.09E-07 | 0.2 | as As |
| Barium | 1.21E-03 | | 1.95E-01 | 1.12E-05 | 2.23E-05 | 5.11E-08 | 1.02E-06 | 0.5 | as Ba |
| Boron as B(OH)4- | 2.61E-02 | | 8.43E+00 | 4.82E-04 | 4.82E-04 | 2.21E-06 | 2.21E-05 | 1 | as borate |
| Cadmium | 2.36E-01 | | 3.81E+00 | 2.18E-04 | 4.36E-03 | 9.99E-07 | 2.00E-04 | 0.05 | as Cd |
| Calcium | 0.00E+00 | | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 10 | as carbonate or silicate |
| Chromium | 1.67E-01 | | 2.70E+00 | 1.54E-04 | 3.09E-03 | 7.07E-07 | 1.41E-04 | 0.05 | as Cr (VI) |
| Lead | 3.55E-03 | | 1.72E-01 | 9.84E-06 | 6.56E-05 | 4.51E-08 | 3.01E-06 | 0.15 | as Pb inorg dust & fumes |
| Magnesium | 6.75E-03 | | 2.18E+01 | 1.25E-03 | 1.25E-04 | 5.72E-06 | 5.72E-06 | 10 | as MgO fume |
| Mercury | 3.25E-03 | | 1.05E-02 | 6.01E-07 | 6.01E-05 | 2.75E-09 | 2.75E-06 | 0.01 | as Hg skin & alkyl compds |
| Nickel | 2.36E-03 | | 7.63E-01 | 4.37E-05 | 4.37E-05 | 2.00E-07 | 2.00E-06 | 1 | as ni insoluble compounds |
| Potassium | 2.45E-02 | | 7.92E+01 | 4.53E-03 | 4.53E-04 | 2.08E-05 | 2.08E-05 | 10 | PNOC |
| Silver | 4.48E-02 | | 1.45E-01 | 8.29E-06 | 8.29E-04 | 3.80E-08 | 3.80E-05 | 0.01 | as Ag |
| Sodium | 3.85E-02 | | 1.24E+02 | 7.12E-03 | 7.12E-04 | 3.26E-05 | 3.26E-05 | 10 | PNOC |
| Ammonia | 1.73E-05 | | 9.50E-02 | 5.44E-06 | 3.20E-07 | 2.49E-08 | 1.47E-08 | 17 | as NH3 |
| CN- | 7.22E-05 | | 1.17E-01 | 6.68E-06 | 1.34E-06 | 3.06E-08 | 6.12E-08 | 5 | as CN |
| Cl- | 0.00E+00 | | 1.18E+01 | 6.78E-04 | 0.00E+00 | 3.10E-06 | 0.00E+00 | | |
| NO3- | 0.00E+00 | | 3.50E+01 | 2.00E-03 | 0.00E+00 | 9.17E-06 | 0.00E+00 | | |
| SO4 = | 0.00E+00 | | 1.35E+01 | 7.72E-04 | 0.00E+00 | 3.54E-06 | 0.00E+00 | | |
| Total Organic Carbon | 0.00E+00 | | 5.84E+00 | 3.34E-04 | 0.00E+00 | 1.53E-06 | 0.00E+00 | | |
| Total | 9.53E-02 | | 3.08E+02 | 1.76E-02 | 1.76E-03 | 8.07E-05 | 8.07E-05 | 10 | PNOC |
| Sum of Fraction = | 5.54E-01 | | | | 1.02E-02 | | 4.69E-04 | | |
| TDS | | | | | | | | | |
| Moisture - Gravimetric % | | | | | | | | | |
| Moisture - Karl Fisher % | | | | | | | | | |
| Specific Gravity | | | | | | | | | |
| | Rem CEDE | | Curies | uCi/cc | Rem CEDE | uCi/cc | Rem CEDE | Rem/Ci | Inhalation |
| Gross Alpha - pCi/g | 1.37E-03 | | 4.95E-09 | 2.83E-13 | 2.53E-05 | 1.30E-15 | 1.16E-07 | 4.30E+08 | Assumes all Pu-239 |
| Gross Beta - pCi/g | 3.93E-06 | | 7.39E-10 | 4.23E-14 | 7.25E-08 | 1.94E-16 | 3.32E-10 | 8.25E+06 | Assumes all Pu-241 |
| Volume in Liters | | | | | | | | | |
| Sludge Dry Weight, KG | | | | | | | | | |
| Sludge Weight KG | | | | | | | | | |
| Sludge Volume gallons | | | | | | | | | |
| # of 10000 gallon tanks | | | | | | | | | |

By [illegible] Date 1/13/94 CHK. By [illegible] Date 1-13-94

| | | | | | | |
|---|---|---|---|---|---|---|
| | Less than multiplier = | | 1 | Weston Solar Pond Sludge Data | | |
| Analyte | Molecular Weight | 207C-NW-SL mg/kg | 207C-NE-SL mg/kg | 207C-SW-SL mg/kg | 207C-SE-SL mg/kg | 207C-CP-SL mg/kg |
| 2-Butanone | 72.12 | | | | | |
| Benzene | 78.12 | | | | | |
| Tetrachloroethylene | 165.8 | | | | | |
| Trichloroethylene | 131.4 | | | | | |
| Pyrene | 202.26 | | | | | |
| Aluminum | 26.98 | 69.5 | 132 | 1330 | 82.4 | 97.2 |
| Antimony | 121.75 | 10.1 | 12.1 | 13.8 | 12.1 | 13 |
| Arsenic | 74.92 | 2.2 | 2 | 2.7 | 2 | 2 |
| Barium | 137.33 | | | | | |
| Beryllium | 9.012 | 0.85 | 1.1 | 17.6 | 1 | 1.1 |
| Boron as B(OH)4- | 78.84 | 5.75E+02 | 8.68E+02 | 1.01E+04 | 7.51E+02 | 8.53E+02 |
| Cadmium | 112.41 | 3.2 | 5.8 | 116 | 4.5 | 5.6 |
| Calcium | 40.08 | 845 | 1010 | 1550 | 1010 | 1080 |
| Chromium | 51.996 | 16 | 21.6 | 365 | 19.2 | 17.6 |
| Copper | 63.546 | 4.3 | 5.8 | 78 | 5.1 | 6.3 |
| Iron | 55.847 | 24.2 | 55.4 | [illegible] | 34.9 | 35 |
| Lead | 207.2 | 0.66 | 0.51 | 2 | 0.61 | 0.59 |
| Lithium | 6.941 | 24 | 36.9 | 108 | 32.7 | 42.8 |
| Magnesium | 24.305 | | | | | |
| Manganese | 54.938 | 2.5 | 3 | 8.7 | 3 | 3.3 |
| Mercury | 200.59 | 0.17 | 0.17 | 0.27 | 0.11 | 0.11 |
| Nickel | 58.71 | 6.8 | 8.1 | 23.1 | 8.1 | 8.7 |
| Potassium | 39.098 | 224000 | 365000 | 16900 | 327000 | 273000 |
| Silicon | 28.086 | 506 | 862 | 6990 | 607 | 422 |
| Silver | 107.87 | 1.7 | 2 | 4.4 | 2 | 2.2 |
| Sodium | 22.99 | 38900 | 49200 | 378000 | 45800 | 50900 |
| Selenium | 78.96 | | | | | |
| Zinc | 65.39 | 5.5 | 7.3 | 18.9 | 4 | 5.5 |
| Chloride | 35.45 | 2860 | 2420 | 8990 | 2830 | 5360 |
| Fluoride | 18.998 | 6320 | 11700 | 39800 | 14800 | 22800 |
| Cyanide | 26 | 2.2 | 1.6 | 5.2 | 9.9 | 3.2 |
| Sulfate | 96 | 28900 | 53900 | 141000 | 68300 | 110000 |
| Nitrite | 46 | 1579.2 | 3290 | 1710.8 | 1776.6 | 2632 |
| Nitrate | 62 | 443000 | 287950 | 575900 | 443000 | 429710 |
| Carbonate | 60 | | | | | |
| Bicarbonate | 61 | | | | | |
| Phosphorus | 30.97 | 1600 | 1300 | 3400 | 1400 | 1700 |
| Ammonia | 17 | 3.28 | 3.28 | 5.46 | 3.46 | 4.13 |
| TOC | | | | | | |
| Total of Identified | | 7.47E-05 | 7.78E-05 | 1.17E-06 | 9.07E-05 | 8.99E-05 |
| Water | | 9.00E-04 | 9.90E-04 | 2.01E-05 | 1.01E-05 | 7.70E-04 |
| Grand Total | | 8.37E-05 | 8.77E-05 | 1.40E-06 | 1.01E-06 | 9.76E-05 |
| TDS (Liquids) | | | | | | |
| % Solids | | 91 | 90.1 | 77.9 | 89.9 | 92.3 |
| Volume, Liters | | | | | | |
| Specific grav. | | | | | | |
| Sludge, Kg Wet | | | | | | |
| | | | | | | |
| | | pCi/g (dry) | pCi/g (dry) | pCi/g (dry) | pCi/g (dry) | pCi/g (dry) |
| Gross alpha | | 29 | 0 | 1200 | 25 | 18 |
| Gross beta | | 500 | 380 | 0 | 420 | 420 |
| U-234 | | 11 | 0.06 | 9.2 | 0.011 | 5.2 |
| U-235 | | 0.36 | 0.1 | 0.4 | 0.016 | 0.84 |
| U-238 | | 16 | 5.3 | 14 | 1.3 | 31 |
| Am-241 | | 0.78 | 0.56 | 0.011 | 0.6 | 1.7 |
| Pu-239 | | 16 | | | 2.9 | 15 |
| Total Specific Isotopes | | | | | | |
| Sum of Gross | | | | | | |

By [illegible] Date 1/13/94 CHK. By [illegible] Date [illegible]

| Analyte | Weston Average 207C mg/kg | Halliburton NUS Average 207C mg/kg | Best Est. Average 207C mg/kg | Conservative Sludge conc. 207C mg/kg | Best Est Sludge conc. 207C mg/L | Conservative Water Conc. 207C mg/L |
|---|---|---|---|---|---|---|
| 2-Butanone | | 8.30E-02 | 8.30E-02 | 8.30E-02 | 1.51E-01 | 1.10E-01 |
| Benzene | | 7.00E-03 | 7.00E-03 | 7.00E-03 | 1.27E-02 | |
| Tetrachloroethylene | | 1.01E-02 | 1.01E-02 | 1.01E-02 | 1.84E-02 | |
| Trichloroethylene | | 6.00E-03 | 6.00E-03 | 6.00E-03 | 1.09E-02 | |
| Pyrene | | 1.90E-01 | 1.90E-01 | 1.90E-01 | 3.46E-01 | |
| Aluminum | 2.50E+02 | | 2.50E+02 | 2.50E+02 | 4.56E+02 | |
| Antimony | 1.25E+01 | | 1.25E+01 | 1.25E+01 | 2.28E+01 | |
| Arsenic | 2.23E+00 | 2.54E+01 | 1.38E+01 | 2.54E+01 | 2.51E+01 | 4.11E+00 |
| Barium | | 2.35E+01 | 2.35E+01 | 2.35E+01 | 4.28E+01 | 1.50E-01 |
| Beryllium | 3.12E+00 | | 3.12E+00 | 3.12E+00 | 5.68E+00 | |
| Boron as B(OH)4- | 1.97E+03 | 3.89E+03 | 2.93E+03 | 3.89E+03 | 5.33E+03 | 3.60E+03 |
| Cadmium | 1.90E+01 | 4.81E+01 | 3.35E+01 | 4.81E+01 | 6.10E+01 | 5.60E-01 |
| Calcium | 1.09E+03 | | 1.09E+03 | 1.09E+03 | 1.99E+03 | |
| Chromium | 6.15E+01 | 5.54E+02 | 3.08E+02 | 5.54E+02 | 5.60E+02 | 3.94E+00 |
| Copper | 1.48E+01 | | 1.48E+01 | 1.48E+01 | 2.69E+01 | 6.79E+00 |
| Iron | 5.87E+01 | | 5.87E+01 | 5.87E+01 | 1.07E+02 | |
| Lead | 7.68E-01 | 1.44E+01 | 7.58E+00 | 1.44E+01 | 1.38E+01 | 3.00E-01 |
| Lithium | 4.66E+01 | | 4.66E+01 | 4.66E+01 | 8.48E+01 | |
| Magnesium | | 2.62E+03 | 2.62E+03 | 2.62E+03 | 4.77E+03 | 3.87E+00 |
| Manganese | 3.80E+00 | | 3.80E+00 | 3.80E+00 | 6.92E+00 | |
| Mercury | 1.45E-01 | 8.75E-01 | 5.10E-01 | 8.75E-01 | 9.28E-01 | |
| Nickel | 1.01E+01 | 3.13E+01 | 2.07E+01 | 3.13E+01 | 3.77E+01 | 5.09E+00 |
| Potassium | 2.53E+05 | 8.29E+04 | 1.68E+05 | 2.53E+05 | 3.06E+05 | 7.87E+04 |
| Silicon | 1.33E+03 | | 1.33E+03 | 1.33E+03 | 2.42E+03 | 3.01E+01 |
| Silver | 2.53E+00 | 5.28E+01 | 2.77E+01 | 5.28E+01 | 5.03E+01 | |
| Sodium | 8.92E+04 | 1.29E+05 | 1.09E+05 | 1.29E+05 | 1.99E+05 | 1.42E+05 |
| Selenium | | | 0.00E+00 | 0.00E+00 | 0.00E+00 | 6.00E+00 |
| Zinc | 7.21E+00 | | 7.21E+00 | 7.21E+00 | 1.31E+01 | 2.00E+00 |
| Chloride | 4.56E+03 | 1.53E+04 | 9.93E+03 | 1.53E+04 | 1.81E+04 | 2.50E+04 |
| Fluoride | 1.92E+04 | | 1.92E+04 | 1.92E+04 | 3.50E+04 | 1.47E+03 |
| Cyanide | 3.96E+00 | 5.00E+01 | 2.70E+01 | 5.00E+01 | 4.91E+01 | 2.00E+01 |
| Sulfate | 9.15E+04 | 2.19E+04 | 5.67E+04 | 9.15E+04 | 1.03E+05 | 1.80E+04 |
| Nitrite | 2.36E+03 | | 2.36E+03 | 2.36E+03 | 4.30E+03 | 8.23E+03 |
| Nitrate | 4.34E+05 | 2.10E+05 | 3.22E+05 | 4.34E+05 | 5.86E+05 | 6.60E+04 |
| Carbonate | | | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.50E+04 |
| Bicarbonate | | | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.00E+03 |
| Phosphorus | 1.81E+03 | | 1.81E+03 | 1.81E+03 | 3.30E+03 | 6.10E+02 |
| Ammonia | 3.99E+00 | | 3.99E+00 | 3.99E+00 | 7.27E+00 | 6.40E+00 |
| TOC | | 7.20E+03 | 7.20E+03 | 7.20E+03 | 1.31E+04 | 5.49E+03 |
| Total of Identified | 9.00E+05 | 4.74E+05 | 7.05E+05 | 9.63E+05 | 1.28E+06 | 3.78E+05 |
| Water | 1.02E+05 | 3.99E+05 | 2.51E+05 | | 4.56E+05 | 9.26E+05 |
| Grand Total | 1.00E+06 | 8.73E+05 | 9.56E+05 | | 1.82E+06 | 1.30E+06 |
| TDS (Liquids) | | | | | | 4.22E+05 |
| % Solids | 89.8 | 60.1 | 74.9 | | | |
| Volume, Liters | | | | | | |
| Specific grav. | | 1.82 | 1.82 | | | 1.343 |
| Sludge, Kg Wet | | | | | | |
| | pCi/g (dry) | pCi/g (dry) | pCi/g (dry) | pCi/g (dry) | pCi/L | pCi/L |
| Gross alpha | 1.66E+02 | 5.15E+03 | 2.66E+03 | 5.15E+03 | 9.37E+06 | 1.30E+05 |
| Gross beta | 3.74E+02 | 7.41E+02 | 5.57E+02 | 7.41E+02 | 1.35E+06 | 2.30E+05 |
| U-234 | 5.13E+00 | | 5.13E+00 | 5.13E+00 | 9.34E+03 | 2.60E+03 |
| U-235 | 5.30E-01 | | 5.30E-01 | 5.30E-01 | 9.64E+02 | 1.20E+02 |
| U-238 | 2.01E+01 | | 2.01E+01 | 2.01E+01 | 3.65E+04 | 3.90E+03 |
| Am-241 | 1.09E+00 | | 1.09E+00 | 1.09E+00 | 1.99E+03 | 2.60E+00 |
| Pu-239 | 1.22E+01 | | 1.22E+01 | 1.22E+01 | 2.22E+04 | 6.70E+02 |
| Total Specific Isotopes | | | | | | |
| Sum of Gross | | | | | | |

By [illegible] Date 1/13/94 CHK. By [illegible] Date [illegible]

Release Fraction = 1.93E-06

| Analyte | Water Conc to 45 wt% TDS 207C mg/L | 45% TDS Soln - 5% Sludge Conc mg/L | 45% TDS Soln - 5% Sludge 450000 gal KG | 45% TDS Soln - 5% Sludge 10000 gal Tk KG | 10000 gallon Tank Spill Worker mg/m3 | Worker Safety Fraction exp/TLV-TWA |
|---|---|---|---|---|---|---|
| 2-Butanone | 1.64E-01 | 1.63E-01 | 2.78E-01 | 6.18E-03 | 3.55E-06 | 6.02E-09 |
| Benzene | | 6.07E-04 | 1.03E-03 | 2.30E-05 | 1.32E-08 | 4.12E-10 |
| Tetrachloroethylene | | 8.78E-04 | 1.49E-03 | 3.32E-05 | 1.91E-08 | 5.63E-11 |
| Trichloroethylene | | 5.20E-04 | 8.86E-04 | 1.97E-05 | 1.13E-08 | 4.20E-11 |
| Pyrene | | 1.65E-02 | 2.80E-02 | 6.23E-04 | 3.58E-07 | 0.00E+00 |
| Aluminum | | 2.17E+01 | 3.70E+01 | 8.21E-01 | 4.72E-04 | 2.36E-04 |
| Antimony | | 1.08E+00 | 1.85E+00 | 4.10E-02 | 2.36E-05 | 4.72E-05 |
| Arsenic | 6.13E+00 | 7.03E+00 | 1.20E+01 | 2.66E-01 | 1.53E-04 | 7.65E-04 |
| Barium | 2.24E-01 | 2.25E+00 | 3.83E+00 | 8.52E-02 | 4.89E-05 | 9.78E-05 |
| Beryllium | | 2.70E-01 | 4.60E-01 | 1.02E-02 | 5.88E-06 | 2.94E-03 |
| Boron as B(OH)4- | 5.37E+03 | 5.36E+03 | 9.14E+03 | 2.03E+02 | 1.17E-01 | 1.17E-01 |
| Cadmium | 8.35E-01 | 3.70E+00 | 6.31E+00 | 1.40E-01 | 8.05E-05 | 1.61E-03 |
| Calcium | | 9.46E+01 | 1.61E+02 | 3.58E+00 | 2.06E-03 | 2.06E-04 |
| Chromium | 5.87E+00 | 3.23E+01 | 5.50E+01 | 1.22E+00 | 7.02E-04 | 1.40E-02 |
| Copper | 1.01E+01 | 1.09E+01 | 1.86E+01 | 4.13E-01 | 2.38E-04 | 2.38E-04 |
| Iron | | 5.09E+00 | 8.68E+00 | 1.93E-01 | 1.11E-04 | 1.11E-04 |
| Lead | 4.47E-01 | 1.08E+00 | 1.85E+00 | 4.10E-02 | 2.36E-05 | 1.57E-04 |
| Lithium | | 4.04E+00 | 6.88E+00 | 1.53E-01 | 8.78E-05 | 8.78E-06 |
| Magnesium | 5.77E+00 | 2.33E+02 | 3.96E+02 | 8.80E+00 | 5.06E-03 | 5.06E-04 |
| Manganese | | 3.29E-01 | 5.61E-01 | 1.25E-02 | 7.16E-06 | 1.43E-06 |
| Mercury | | 4.42E-02 | 7.53E-02 | 1.67E-03 | 9.61E-07 | 9.61E-05 |
| Nickel | 7.59E+00 | 9.02E+00 | 1.54E+01 | 3.41E-01 | 1.96E-04 | 1.96E-04 |
| Potassium | 1.17E+05 | 1.26E+05 | 2.15E+05 | 4.78E+03 | 2.75E+00 | 2.75E-01 |
| Silicon | 4.49E+01 | 1.58E+02 | 2.69E+02 | 5.99E+00 | 3.44E-03 | 3.44E-04 |
| Silver | | 2.40E+00 | 4.08E+00 | 9.08E-02 | 5.21E-05 | 5.21E-03 |
| Sodium | 2.12E+05 | 2.11E+05 | 3.60E+05 | 7.99E+03 | 4.59E+00 | 4.59E-01 |
| Selenium | 8.94E+00 | 8.52E+00 | 1.45E+01 | 3.22E-01 | 1.85E-04 | 9.26E-04 |
| Zinc | 2.98E+00 | 3.46E+00 | 5.90E+00 | 1.31E-01 | 7.53E-05 | 7.53E-06 |
| Chloride | 3.73E+04 | 3.64E+04 | 6.19E+04 | 1.38E+03 | 7.90E-01 | 0.00E+00 |
| Fluoride | 2.19E+03 | 3.75E+03 | 6.39E+03 | 1.42E+02 | 8.16E-02 | 3.26E-02 |
| Cyanide | 2.98E+01 | 3.07E+01 | 5.24E+01 | 1.16E+00 | 6.68E-04 | 1.34E-04 |
| Sulfate | 2.68E+04 | 3.05E+04 | 5.19E+04 | 1.15E+03 | 6.63E-01 | 0.00E+00 |
| Nitrite | 1.23E+04 | 1.19E+04 | 2.03E+04 | 4.50E+02 | 2.59E-01 | 0.00E+00 |
| Nitrate | 9.84E+04 | 1.22E+05 | 2.07E+05 | 4.60E+03 | 2.64E+00 | 0.00E+00 |
| Carbonate | 3.73E+04 | 3.55E+04 | 6.05E+04 | 1.34E+03 | 7.72E-01 | 0.00E+00 |
| Bicarbonate | 5.96E+03 | 5.68E+03 | 9.67E+03 | 2.15E+02 | 1.23E-01 | 0.00E+00 |
| Phosphorus | 9.09E+02 | 1.02E+03 | 1.74E+03 | 3.87E+01 | 2.22E-02 | 0.00E+00 |
| Ammonia | 9.54E+00 | 9.43E+00 | 1.61E+01 | 3.57E-01 | 2.05E-04 | 1.21E-05 |
| TOC | 8.18E+03 | 8.42E+03 | 1.43E+04 | 3.19E+02 | 1.83E-01 | 0.00E+00 |
| Total of Identified | 5.64E+05 | 5.98E+05 | 1.02E+06 | 2.26E+04 | 1.30E+01 | 1.30E+00 |
| Water | 7.64E+05 | 7.49E+05 | 1.28E+06 | 2.84E+04 | Sum | |
| Grand Total | 1.39E+06 | 1.41E+06 | 2.40E+06 | 5.10E+04 | of Fraction = | 9.11E-01 |
| TDS (Liquids) | 6.29E+05 | | 1.08E+06 | | | |
| % Solids | | TSS = | 1.20E+05 | | | |
| Volume, Liters | | | Total Solids In | | | |
| Specific grav. | 1.389 | 1.410 | 2.85E+06 | Air Volume (m3) = | 3350 | |
| Sludge, Kg Wet | | | | | | |
| | | 0.05 | | | | |
| | pCi/L | pCi/L | Curies | Curies | uCi/cc | Rem CEDE |
| Gross alpha | 1.94E+05 | 6.31E+05 | 1.07E+00 | 2.39E-02 | 1.37E-11 | 1.23E-03 |
| Gross beta | 3.43E+05 | 3.91E+05 | 6.66E-01 | 1.48E-02 | 8.50E-12 | 1.46E-05 |
| U-234 | 3.88E+03 | 4.14E+03 | 7.05E-03 | 1.57E-04 | 8.99E-14 | 1.48E-07 |
| U-235 | 1.79E+02 | 2.16E+02 | 3.68E-04 | 8.19E-06 | 4.70E-15 | 7.14E-09 |
| U-238 | 5.81E+03 | 7.29E+03 | 1.24E-02 | 2.78E-04 | 1.59E-13 | 2.31E-07 |
| Am-241 | 1.28E+01 | 1.07E+02 | 1.82E-04 | 4.05E-06 | 2.33E-15 | 2.14E-07 |
| Pu-239 | 9.99E+02 | 2.01E+03 | 3.42E-03 | 7.60E-05 | 4.37E-14 | 3.90E-06 |
| Total Specific Isotopes | | | 2.34E-02 | | | 4.50E-06 |
| Sum of Gross | | | 1.74E+00 | | | 1.24E-03 |

By [illegible] Date 11/13/94 CHK. By [illegible] Date [illegible]

| Analyte | 3232 gal Truck 45% TDS soln + 5% sludge KG | Truck Spill Worker Exposure mg/m3 | Worker Safety Fraction exp/TLV-TWA | X/Q (s/m3) 5.15E-02 On-site Co-located Worker mg/m3 | Co-located Worker Safety Fraction exp/TLV-TWA | X/Q (s/m3) 2.36E-04 Maximum Off-site Individual mg/m3 |
|---|---|---|---|---|---|---|
| 2-Butanone | 2.00E-03 | 3.86E-06 | 6.54E-09 | 2.21E-07 | 3.74E-10 | 1.01E-09 |
| Benzene | 7.42E-06 | 1.43E-08 | 4.48E-10 | 8.20E-10 | 2.56E-11 | 3.76E-12 |
| Tetrachloroethylene | 1.07E-05 | 2.07E-08 | 6.11E-11 | 1.19E-09 | 3.50E-12 | 5.43E-12 |
| Trichloroethylene | 6.36E-06 | 1.23E-08 | 4.56E-11 | 7.03E-10 | 2.61E-12 | 3.22E-12 |
| Pyrene | 2.01E-04 | 3.89E-07 | 0.00E+00 | 2.22E-08 | 0.00E+00 | 1.02E-10 |
| Aluminum | 2.65E-01 | 5.12E-04 | 2.56E-04 | 2.93E-05 | 1.47E-05 | 1.34E-07 |
| Antimony | 1.33E-02 | 2.56E-05 | 5.12E-05 | 1.47E-06 | 2.93E-06 | 6.71E-09 |
| Arsenic | 8.60E-02 | 1.66E-04 | 8.30E-04 | 9.50E-06 | 4.75E-05 | 4.35E-08 |
| Barium | 2.75E-02 | 5.31E-05 | 1.06E-04 | 3.04E-06 | 6.08E-06 | 1.39E-08 |
| Beryllium | 3.31E-03 | 6.38E-06 | 3.19E-03 | 3.65E-07 | 1.83E-04 | 1.67E-09 |
| Boron as B(OH)4- | 6.56E+01 | 1.27E-01 | 1.27E-01 | 7.25E-03 | 7.25E-03 | 3.32E-05 |
| Cadmium | 4.53E-02 | 8.74E-05 | 1.75E-03 | 5.00E-06 | 1.00E-04 | 2.29E-08 |
| Calcium | 1.16E+00 | 2.23E-03 | 2.23E-04 | 1.28E-04 | 1.28E-05 | 5.86E-07 |
| Chromium | 3.95E-01 | 7.62E-04 | 1.52E-02 | 4.36E-05 | 8.72E-04 | 2.00E-07 |
| Copper | 1.34E-01 | 2.58E-04 | 2.58E-04 | 1.48E-05 | 1.48E-05 | 6.76E-08 |
| Iron | 6.22E-02 | 1.20E-04 | 1.20E-04 | 6.87E-06 | 6.87E-06 | 3.15E-08 |
| Lead | 1.33E-02 | 2.56E-05 | 1.71E-04 | 1.46E-06 | 9.76E-06 | 6.71E-09 |
| Lithium | 4.94E-02 | 9.54E-05 | 9.54E-06 | 5.46E-06 | 5.46E-07 | 2.50E-08 |
| Magnesium | 2.85E+00 | 5.49E-03 | 5.49E-04 | 3.14E-04 | 3.14E-05 | 1.44E-06 |
| Manganese | 4.03E-03 | 7.78E-06 | 1.56E-06 | 4.45E-07 | 8.90E-08 | 2.04E-09 |
| Mercury | 5.41E-04 | 1.04E-06 | 1.04E-04 | 5.97E-08 | 5.97E-06 | 2.74E-10 |
| Nickel | 1.10E-01 | 2.13E-04 | 2.13E-04 | 1.22E-05 | 1.22E-05 | 5.59E-08 |
| Potassium | 1.55E+03 | 2.98E+00 | 2.98E-01 | 1.71E-01 | 1.71E-02 | 7.82E-04 |
| Silicon | 1.93E+00 | 3.73E-03 | 3.73E-04 | 2.14E-04 | 2.14E-05 | 9.79E-07 |
| Silver | 2.93E-02 | 5.66E-05 | 5.66E-03 | 3.24E-06 | 3.24E-04 | 1.48E-08 |
| Sodium | 2.58E+03 | 4.98E+00 | 4.98E-01 | 2.85E-01 | 2.85E-02 | 1.31E-03 |
| Selenium | 1.04E-01 | 2.01E-04 | 1.01E-03 | 1.15E-05 | 5.75E-05 | 5.27E-08 |
| Zinc | 4.24E-02 | 8.18E-05 | 8.18E-06 | 4.69E-06 | 4.69E-07 | 2.15E-08 |
| Chloride | 4.45E+02 | 8.58E-01 | 0.00E+00 | 4.91E-02 | 0.00E+00 | 2.25E-04 |
| Fluoride | 4.59E+01 | 8.86E-02 | 8.85E-02 | 5.07E-03 | 5.03E-03 | 2.32E-05 |
| Cyanide | 3.76E-01 | 7.26E-04 | 1.45E-04 | 4.15E-05 | 8.31E-06 | 1.90E-07 |
| Sulfate | 3.73E+02 | 7.19E-01 | 0.00E+00 | 4.12E-02 | 0.00E+00 | 1.89E-04 |
| Nitrite | 1.45E+02 | 2.81E-01 | 0.00E+00 | 1.61E-02 | 0.00E+00 | 7.36E-05 |
| Nitrate | 1.49E+03 | 2.87E+00 | 0.00E+00 | 1.64E-01 | 0.00E+00 | 7.53E-04 |
| Carbonate | 4.34E+02 | 8.38E-01 | 0.00E+00 | 4.80E-02 | 0.00E+00 | 2.20E-04 |
| Bicarbonate | 6.95E+01 | 1.34E-01 | 0.00E+00 | 7.67E-03 | 0.00E+00 | 3.52E-05 |
| Phosphorus | 1.25E+01 | 2.42E-02 | 0.00E+00 | 1.38E-03 | 0.00E+00 | 6.33E-06 |
| Ammonia | 1.15E-01 | 2.23E-04 | 1.31E-05 | 1.27E-05 | 7.50E-07 | 5.84E-08 |
| TOC | 1.03E+02 | 1.99E-01 | 0.00E+00 | 1.14E-02 | 0.00E+00 | 5.21E-05 |
| Total of Identified | 7.32E+03 | 1.41E+01 | 1.41E+00 | 8.08E-01 | 8.08E-02 | 3.70E-03 |
| Water | 9.73E+03 | Sum | | Sum | | Sum |
| Grand Total | 1.70E+04 | of Fraction = 9.89E-01 | | of Fraction = 8.66E-02 | | of Fraction = |
| TDS (Liquids) | | | | | | |
| % Solids | | | | | | |
| Volume, Liters | | | | | | |
| Specific grav. | | | | | | |
| Sludge, Kg Wet | | | | | | |

| | Curies | uCi/cc | Rem CEDE | uCi/cc | Rem CEDE | uCi/cc |
|---|---|---|---|---|---|---|
| Gross alpha | 8.19E-03 | 4.71E-12 | 4.21E-04 | 9.05E-13 | 8.09E-05 | 4.15E-15 |
| Gross beta | 5.07E-03 | 2.91E-12 | 5.00E-06 | 5.60E-13 | 9.61E-07 | 2.57E-15 |
| U-234 | 5.37E-05 | 3.08E-14 | 5.08E-08 | 5.93E-15 | 9.73E-09 | 2.72E-17 |
| U-235 | 2.81E-06 | 1.61E-15 | 2.45E-09 | 3.10E-16 | 4.71E-10 | 1.42E-18 |
| U-238 | 9.45E-05 | 5.43E-14 | 7.91E-08 | 1.04E-14 | 1.52E-08 | 4.78E-17 |
| Am-241 | 1.39E-06 | 7.98E-16 | 7.35E-08 | 1.53E-16 | 1.41E-08 | 7.03E-19 |
| Pu-239 | 2.61E-05 | 1.50E-14 | 1.34E-06 | 2.88E-15 | 2.57E-07 | 1.32E-17 |
| Total Specific Isotopes | | | 1.54E-06 | | 2.97E-07 | |
| Sum of Gross | | | 4.26E-04 | | 8.13E-05 | |

By [illegible] Date 1/12/94 CHK. By [illegible] Date 1-13-94

| Analyte | MOI Safety Fraction exp/(0.1*TWA) | TLV-TWA mg/m3 | TLV-STEL mg/m3 | |
|---|---|---|---|---|
| 2-Butanone | 1.71E-11 | 590 | 885 | |
| Benzene | 1.17E-12 | 32 | | |
| Tetrachloroethylene | 1.60E-13 | 339 | 1357 | |
| Trichloroethylene | 1.20E-13 | 269 | 1070 | |
| Pyrene | 0.00E+00 | | | |
| Aluminum | 6.72E-07 | 2 | | as Al soulble salts |
| Antimony | 1.34E-07 | 0.5 | | as Sb compounds |
| Arsenic | 2.18E-06 | 0.2 | | as As |
| Barium | 2.79E-07 | 0.5 | | as Ba |
| Beryllium | 8.37E-06 | 0.002 | | as Be |
| Boron as B(OH)4- | 3.32E-04 | 1 | | as borate |
| Cadmium | 4.58E-06 | 0.05 | | as Cd |
| Calcium | 5.86E-07 | 10 | | as carbonate or silicate |
| Chromium | 4.00E-05 | 0.05 | | as Cr (VI) |
| Copper | 6.76E-07 | 1 | | as Cu dust & mist |
| Iron | 3.15E-07 | - | | as Fe soluble salts |
| Lead | 4.47E-07 | 0.15 | | as Pb inorg dust & fumes |
| Lithium | 2.50E-08 | 10 | | PNOC |
| Magnesium | 1.44E-06 | 10 | | MgO fume |
| Manganese | 4.08E-09 | 5 | | as Mn dust & compounds |
| Mercury | 2.74E-07 | 0.01 | 0.03 | as Hg skin & alkyl compounds |
| Nickel | 5.59E-07 | 1 | | as Ni insoluble compounds |
| Potassium | 7.82E-04 | 10 | | PNOC |
| Silicon | 9.79E-07 | 10 | | precipitated silica |
| Silver | 1.48E-05 | 0.01 | | as Ag |
| Sodium | 1.31E-03 | 10 | | PNOC |
| Selenum | 2.64E-06 | 0.2 | | as Se |
| Zinc | 2.15E-08 | 10 | | ZnO dust |
| Chloride | 0.00E+00 | | | |
| Fluoride | 9.30E-05 | 2.5 | | as F, fluorides |
| Cyanide | 3.81E-07 | 5 | | as CN |
| Sulfate | 0.00E+00 | | | |
| Nitrite | 0.00E+00 | | | |
| Nitrate | 0.00E+00 | | | |
| Carbonate | 0.00E+00 | | | |
| Bicarbonate | 0.00E+00 | | | |
| Phosphorus | 0.00E+00 | | | |
| Ammonia | 3.44E-08 | 17 | 24 | as NH3 |
| TOC | 0.00E+00 | | | |
| Total of Identified | 3.70E-03 | 10 | | PNOC - (Particulate not otherwise classified) |
| Water | | | | |
| Grand Total | 2.59E-03 | | | |
| TDS (Liquids) | | | | |
| % Solids | | | | |
| Volume, Liters | | | | |
| Specific grav. | | | | |
| Sludge, Kg Wet | | | | |

| | Rem CEDE | Rem/Ci | Inhalation |
|---|---|---|---|
| Gross alpha | 3.71E-07 | 4.30E+08 | Assumes all Pu-239 |
| Gross beta | 4.40E-09 | 9.25E+06 | Assumes all Pu-241 |
| U-234 | 4.46E-11 | 7.99E+06 | Class W |
| U-235 | 2.16E-12 | 7.30E+06 | Class W |
| U-238 | 6.97E-11 | 7.01E+06 | Class W |
| Am-241 | 6.48E-11 | 4.43E+08 | Class W |
| Pu-239 | 1.18E-09 | 4.30E+08 | Class W |
| Total Specific Isotopes | 1.36E-09 | | |
| Sum of Gross | 3.75E-07 | | |

Subject Hazard Calculation for Remediation of 207C Pond and Clarifier
By A.E. Stalk Date 1/7/94 Chk. By G.S. Rayfel Date 1-13-94 Orig. ☒ Rev. ☐

2.C. Volumes of sludge and liquid.

1. Pond 207C - The entire contents of the Pond will be stored in 10,000 gallon tanks. The plan, per Leon Collins is to circulate and dissolve as much salt as possible. Try to get ~45% TDS in the solution. 45% TDS solution will have a specific gravity of 1.398 as calculated on page 17 of this calculation. Preparing for a mixture of solution and solid sludge material (Total Suspended Solids [TSS]). up to 5% TSS. The total volume of solution + sludge is planned to be 450000 gallons, which includes washdown water.

Brown & Root Calculation from August 4, 1992 measurement data provides the following total solids evaluation:

| | | | |
|---|---|---|---|
| Sludge/Silt | 348,125 | lbs | dry solids |
| Crystal Mush | 361,805 | lbs | dry solids |
| Soln in sludge/silt | 110,365 | lbs | TDS |
| Soln in Xtal mush | 231 728 | lbs | TDS |
| Soln above Xtal layer | 1,588,811 | lbs | TDS |
| Total lbs of solids. | 2640834 | lbs | Total solids in 207C Pond. |

450000 gallons * 3.7854 L/gal * 1.409 KG/L * (.45 TDS + .05 TSS) = $1.2 \times 10^6$ KG

$1.2 \times 10^6$ kg * 2.2046 lb/kg = $2.646 \times 10^6$ lbs.

2. Clarifier

Sludge 11,900 gallons * 3.7854 L/gal = $4.50 \times 10^4$
Solution 15000 gallons. * 3.7854 L/gal = $5.68 \times 10^4$

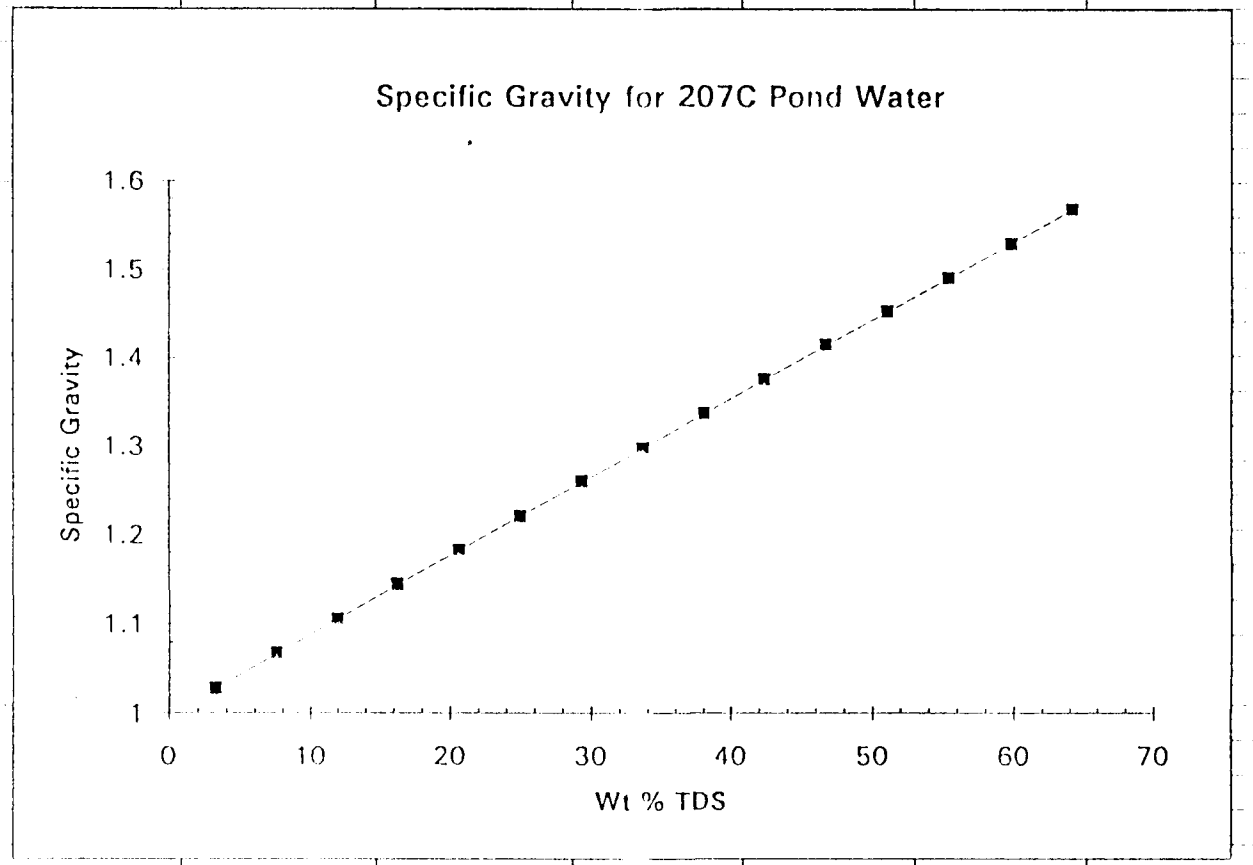
d. Release Fractions

Release fractions for the sludges and slurries

By A C Stalker Date 1/12/94 Chk. By G S Reybal Date 1-12-94

207C Pond Liquid Specific Gravity to % TDS Correlation

| Wt % TDS | Solution SG | Calculated SG | | | |
|---|---|---|---|---|---|
| | | | 0.008852714 | 0.999753817 | #N/A |
| 3.21 | 1.028 | 1.028 | 4.13148E-06 | 0.000159453 | #N/A |
| 7.57 | 1.067 | 1.067 | 0.999997169 | 0.000301074 | #N/A |
| 11.92 | 1.105 | 1.105 | 4591365.077 | 13 | #N/A |
| 16.28 | 1.144 | 1.144 | 0.416185755 | 1.17839E-06 | #N/A |
| 20.63 | 1.182 | 1.182 | | | |
| 24.99 | 1.221 | 1.221 | | | |
| 29.34 | 1.26 | 1.259 | | | |
| 33.7 | 1.298 | 1.298 | | | |
| 38.05 | 1.337 | 1.337 | | | |
| 42.41 | 1.375 | 1.375 | | | |
| 46.76 | 1.414 | 1.414 | | | |
| 51.12 | 1.452 | 1.452 | | | |
| 55.47 | 1.491 | 1.491 | | | |
| 59.83 | 1.529 | 1.529 | | | |
| 64.18 | 1.568 | 1.568 | | | |
| 45 | | 1.398 | | | |

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2.d. cont. are based on the work by Ballinger & Hodson (NUREG/CR-4658, 1986). The least squares fit for the data with the upper 95% confidence level is given on pages 19 and 20 of this calculation. From this calculation a release fraction for each of the various solutions can be calculated.

| Material | viscosity cP | Release Fraction @ 95% ch. |
|---|---|---|
| 207C - 45% TDS + 5% TSS | 50 | $1.93 \times 10^{-6}$ |
| Clarifier mixed solution & sludge | 400 | $3.55 \times 10^{-7}$ |
| 207C Liquid | 19 | $4.10 \times 10^{-6}$ |

3. Online Accidents

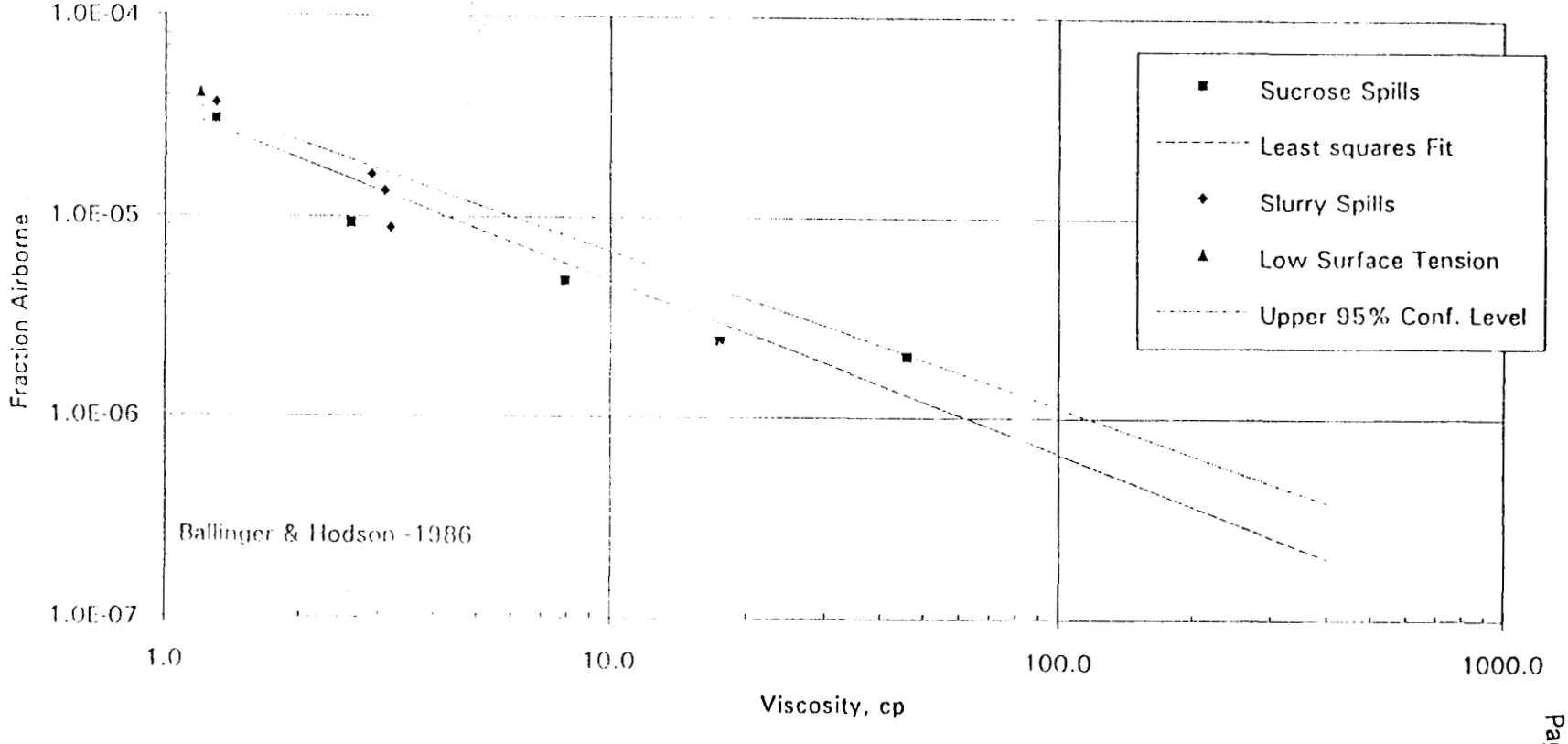
a. 207C Pond

The pond will have sufficient water added to provide a total volume of 450000 gallons. This will be mixed to solubilize as much of the soluble salt as possible and then the insoluble sludge/silt/salt mixture will be mixed to the extent possible. This solution/slurry will be ~~pumped~~ sucked with the "SUCKER" truck at the solar pond, driven into the tent containing the double walled polyethylene tanks. The truck volume is 3232 gallons. Two accidents are to be analyzed. Complete spillage of the truck outside of the tent and complete spillage of one 10,000 gallon tank inside of the tent.

By [illegible] Date 1/13/94 Chk.By G S Rayfel Date 1-13-94

## Fraction Airborne from Sucrose and Slurry Spills

NUREG/CR-4658

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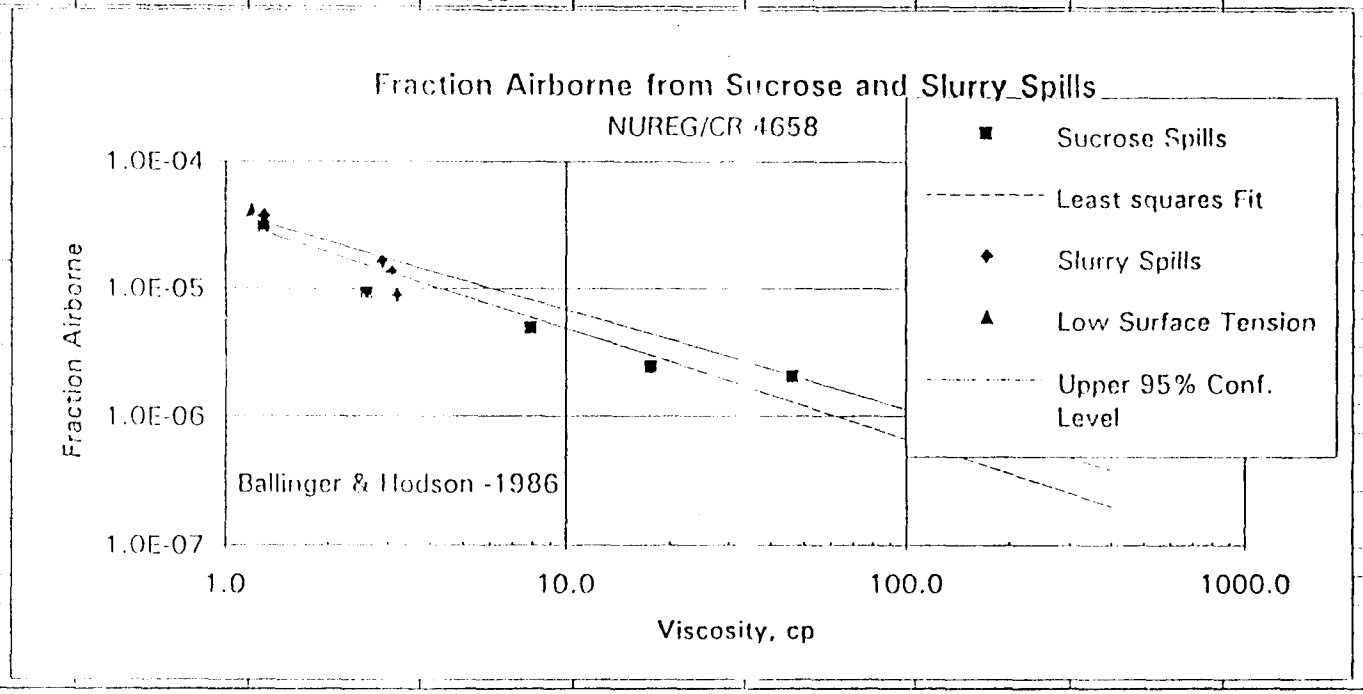
By A.C. Stalke Date 1/13/94 Chk. By [illegible] Date 1-13-94

| Viscosity cp | Fraction Airborne | LOG Viscosity cp | LOG Fraction Airborne | Calculated Fraction Airborne | + 2 sigma Calculated Fraction Airborne | Regression Analysis m | b | Sucrose | Slurry | Low Surface Tension |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.3 | 3.0E-05 | 0.262364264 | -10.41098539 | 2.79E-05 | 3.29E-05 | -0.860537342 | -10.26122295 | 3.0E-05 | | |
| 2.6 | 9.2E-06 | 0.955511445 | -11.59630707 | 1.54E-05 | 1.92E-05 | 0.084005488 | 0.143374146 | 9.2E-06 | | |
| 7.9 | 4.8E-06 | 2.066862759 | -12.24689464 | 5.90E-06 | 8.11E-06 | 0.921008221 | 0.315630167 | 4.8E-06 | | |
| 17.5 | 2.4E-06 | 2.862200881 | -12.94004182 | 2.98E-06 | 4.37E-06 | 104.935907 | 9 | 2.4E-06 | | |
| 46.0 | 2.0E-06 | 3.828641396 | -13.12236338 | 1.30E-06 | 2.06E-06 | 10.45396712 | 0.896601619 | 2.0E-06 | | |
| 1.3 | 3.7E-05 | 0.262364264 | -10.21546232 | 2.79E-05 | 3.29E-05 | | | | 3.7E-05 | |
| 1.3 | 3.0E-05 | 0.262364264 | -10.40766863 | 2.79E-05 | 3.29E-05 | | | | 3.0E-05 | |
| 2.9 | 1.6E-05 | 1.064710737 | -11.04292184 | 1.40E-05 | 1.77E-05 | | | | 1.6E-05 | |
| 3.1 | 1.3E-05 | 1.131402111 | -11.22025585 | 1.32E-05 | 1.68E-05 | | | | 1.3E-05 | |
| 3.2 | 8.7E-06 | 1.16315081 | -11.65218753 | 1.29E-05 | 1.64E-05 | | | | 8.7E-06 | |
| 1.2 | 4.1E-05 | 0.182321557 | -10.10193849 | 2.99E-05 | 3.50E-05 | | | | | 4.1E-05 |
| 19.0 | | 2.944438979 | | 2.77E-06 | 4.10E-06 | | | | | |
| 400.0 | | 5.991464547 | | 2.02E-07 | 3.85E-07 | | | | | |
| 50.0 | | 3.912023005 | | 1.21E-06 | 1.93E-06 | | | | | |




Enclosure 1
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Subject Hazard Calculation For Remediation of 207C Pond + Clarifier
By A.E. Stalker Date 1/7/94 Chk. By G S Roylt Date 1-13-94 Orig. ☒ Rev. ☐

3. a. cont': A minimum of 45 tanks will be required. Two cases will be considered 1) The expected 45% TDS + 5% TSS case, and 2) 207C liquid only.

b. Clarifier

The clarifier liquid solution will be mixed with the sludge to form a pumpable slurry. This slurry will be sucked into the "Guzzler" truck at the clarifier, driven to the tent with the 10000 gallon tanks, and the sludge/slurry will be pumped into a tank. Two accident cases will be evaluated: 1) complete spillage of the truck outside of the tent and complete spillage of one 10,000 gallon tank inside of the tent. Three tanks will be required to hold the contents of the clarifier.

4. HAZARD CALCULATION

For the local worker

$$\text{Air concentration} = \frac{\text{Material-at-risk (MAR)} * \text{Release Fraction (RF)}}{\text{Air volume}}$$

For the co-located worker and off-site person

$$\text{air conc} = \frac{\text{MAR} * \text{RF} * \chi/Q \text{ (atmospheric dispersion)}}{\text{duration of release}}$$

Release Fractions were covered under 2.d pages 16, 18-20.

a. Atmospheric Dispersion

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By: [signature] Date: 1/7/94 Chk. By: G. S. Raybal Date: 1-13-94 Orig. ☒ Rev. ☐

4.a. cont.

Two different volumes are used for the local dispersion volume. 1000 $m^3$ is use for the clairifyer solution sludge, due to the high viscosity (400 cP) that is expected, the sludge from a spilled tank will spread throughout the entire tent. The liquids from 207C Pond, however, will spread throughout the entire tent so the tent #4 free volume is used, 3360 $m^3$.

For the onsite co-located worker and off-site individual F stability class with 1 m/s wind speed meteorology is assumed.

Sheets 6, 9, 10, 13, 14 contain the calculated exposure concentrations.

b. Toxic Chemical Exposure

The Threshold Limit Values - Time Weighted Average (TLV-TWA) as published by the American Conference of Governmental Industrial Hygienists (ACGIH) is used in this evaluation as the endpoint for comparison. For the local worker and the on-site co-located worker, the TLV-TWA is used directly. For the off-site maximum exposed individual (MOI) 0.1 * TLV-TWA is used.

The safety fraction $= \sum_i \frac{\text{conc. chemical form } i}{\text{TLV-TWA } i}$

and the safety fraction is compared to 1.0

The resultant safety fraction calculation are

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4. b. cont.

found on sheets 6, 10, 13, 14, & 15. The TLV-TWAs are listed on sheets 7, 10, & 15.

c. Radiological Exposure

All releases are assumed to occur over a 15 minute (900 seconds) period. The exposure is also assumed to occur over this period. The results of the exposure is given in Rem committed effective dose equivalent (CEDE) to the whole body due to inhalation of the radionuclides. Dose conversion factors are taken from ICRP-30 as published in Federal Guidance Report #11. Gross α is assumed to be $^{239}Pu$ and gross β is assumed to be all $^{241}Pu$. Results of the calculation are shown on sheets 6, 7, 10, 13, 14 and 15.

5. Conclusions

The 207C sludge, solution, and the clarifier sludge/solution mixture can be safely transported to and stored on the TSA Pad.

** QA RECORD WHEN COMPLETED **

# NUCLEAR SAFETY ENGINEERING CALCULATION GENERAL CHECKING CRITERIA

Calculation No.: 94-SAE-001 Checked By: G S Rayfield Date: 2-13-94

Title: Hazard Calculation for Remediation of 207C Pond and Clairifyer

| Hand Calculation Checklist: | Yes | No | N/A | Comments |
|---|---|---|---|---|
| 1. Are analytical methods appropriate? | ✓ | | | |
| 2. Are assumptions correct? | ✓ | | | |
| 3. Is calculation complete? | ✓ | | | |
| 4. Is calculation mathematically accurate? | ✓ | | | |
| 5. Do calculational parameters comply with design criteria/dimensions? | ✓ | | | |
| 6. Were input data appropriate? | ✓ | | | |
| 7. Does the calculation reference or list applicable assumptions and major equation sources? | ✓ | | | |

| Computer Code Checklist: | | | | |
|---|---|---|---|---|
| 1. Was an applicable and valid computer program used?* | | | ✓ | |
| 2. Are assumptions in input correct? | | | ✓ | |
| 3. Was the input entered correctly? | | | ✓ | |
| 4. Do the output results seem reasonable? | | | ✓ | |

Additional Comments:

See review/comment sheet.

* When stored on floppy disk; confirm that the controlled working copy of the applicable diskette was checked out.

NS-049, Rev. 0, (09/09/93)

Nuclear Safety Department
Document Review and Comment Sheet



To: G Roybal
Address: B 886 B

Date: 1 / 13 / 94

Please review the attached (referenced) document, provide your comments (if any), and return this form to: M.C. Stalker
Address: B 883A
Phone: 8487

Due Date:

Document Number: 94-SAE-001 Rev: 0 Draft: Date: / /
Title: Hazard Calculation for Remediation of 207C Pond and Clarifier

- [ ] No comment
- [ ] Comments concerning the document are for consideration prior to approval
- [ ] Comments concerning the document are to be dispositioned before the document is submitted for approval

| ITEM | SECTION OR PARAGRAPH | COMMENT | RESOLUTION |
|---|---|---|---|
| 1 | page 5 of 23 I-27 | NO2 - mg/L should be 2600 not 2969 | 1. $NO_3^-$ in 2500 as (N) must use 3.29 x 2500 = 8225 mg/L. to correct |
| 2 | I-28 | NO3 - mg/L should be 2500 not 11513 | 2. $NO_3^-$ in 2600 as (N) must use 4.43 x 2600 = 11518 mg/L as listed |
| 3 | I-33 | TOC - mg/L should be 54.9 not 5480 | 3. Corrected TOC to 54.9 |
| 4 | I-38 | TDS - mg/L should be 400,000 not 444 000 | 4 Corrected TDS to 400000 |
| 5 | page 11 of 23 C-55 | Gross Beta pCi/g should be 500 not 5 | 5 Corrected to 500 |
| 6 | D-57 | Gross alpha should be 0 not 3022 | 6. Corrected to 0 |
| 7 | D-20 | U-235 should be 0.1 not .098 | 7. Corrected to 0.1 |
| 8 | E-55 | Gross Beta should be 0 not 140 | 8. Corrected to 0 |
| 9 | G-61 | U-235 should be 31. not 3.1 | 9. corrected to 31. |

| Signature of Reviewer | Phone Number | Date | Department |
|---|---|---|---|
| G Roybal | 6113 | 1-13-94 | SAE |

Comments not signed or initialed by addressee will be considered as unofficial comments.

Form NS-006, Rev. 1 (2/22/91)

Nuclear Safety Department
Document Review and Comment Continuation Sheet

Document Number: 94-SAE-001 Revision 0 Draft _____ Page 2 of 2

| ITEM | SECTION OR PARAGRAPH | COMMENT | RESOLUTION |
|---|---|---|---|
| 10 | page 12 of 23 N-8 | 2-Butanone should be 0.11 not 8.30E-02 | 10 Corrected to 0.11 |

Form NS-006A, Rev. 0 (2/22/91)